LIBRARY OF CONGRESS
JUN 21 1880
SMITHSONIAN DEPOSIT.

THE AMERICAN

GAS LIGHT JOURNAL

REMAN & KENNY, N.Y.

PUBLISHING OFFICE No. 42 PINE STREET

DEVOTED TO THE INTERESTS OF ILLUMINATION, VENTILATION, WATER SUPPLY AND DISTRIBUTION, & GENERAL SCIENCE.

VOLUME XXXII.—No. 10.
Whole No. 502.

NEW YORK, MONDAY, MAY 17, 1880.

$3 PER ANNUM
IN ADVANCE.

A. M. CALLENDER & CO., Proprietors.
G. WARREN DRESSER, C.E., Editor.

Terms of Subscription, Including Postage.—For the United States and Canada, $3 per annum. European Countries, $3.50 (15 shillings—18 francs). All payments to be made in advance. Single copies, 15 cents.

Remittances should be made either by post-office order, registered letter, or bank draft on New York, payable to the order of A. M. Callender & Co.

The American News Company, Nos. 39 and 41 Chambers Street, New York, are agents for this Journal. Newsdealers will send orders to them.

Collections are invariably made directly from this office, for subscriptions, advertisements, etc. We have agents to solicit the same, but they are not authorized to receipt for money.

Correspondence.—Wishing to make this Journal a gazette of intelligent discussion to those of our readers who may wish to gain or give information on the subjects to which its columns are devoted, correspondence is solicited for publication from all who make the study of these subjects a pleasure or a profession.

Books.—We will mail, post-paid, at publishers' lowest rates, any book—scientific or otherwise—to any address in the United States or Canada. No books will be sent C. O. D.

ENTERED AT THE POST OFFICE AT NEW YORK, N. Y., AS SECOND CLASS MATTER.

CONTENTS.

☞ An asterisk (*) denotes an illustrated article

The Annual Meeting of the Central New York Gas Association..... 217
Prof. Henry Wurtz—Removal..... 217

EDITORIALS—

Street Lamps Extinguished by an Unusual Atmospheric Disturbance..... 217
Stoking by Machinery..... 218
Pumping Gas at Beckton for Distribution in London..... 218
Gas Inspection in Massachusetts..... 219
Manchester District Institution of Gas Engineers..... 219
Gas Matters in New Bedford..... 225
Spence's Metallic Compound and its Use for Pipe Joints..... 227
Balmain's Luminous Paint..... 227
New Blasting Agent..... 229
A Fire Damp Meter..... 229
Carbonic Oxide..... 229

[OFFICIAL NOTICE.]

The Annual Meeting of the Central New York Gas Engineers Association.

The Annual Meeting of the Central New York Gas Engineers' Association will be held at the Globe Hotel, Syracuse, New York, on Thursday, May 20th, at 10 o'clock, A.M. Papers will be read by Mr. M. Harrington, of Niagara Falls, Mr. W. Cartwright, of Oswego, Mr. J. H. Findlay, of Ogdensburgh, Mr. Wm. Humphreys, of Dansville, Mr. C. A. White, of Rochester. A full attendance of the members is earnestly requested.

CLEMENT A. WHITE, *Secretary.*

PROF. H WURTZ—REMOVAL.

Henry Wurtz, Ph.D., removed on May 1st, 1880, his residence and laboratory from Hoboken, N. J., to New York City. His present address is No. 25 London Terrace, the same being also 447 West Twenty-Third Street. This is a cental location, and is easily accessible from all parts of the city.

STREET LAMPS EXTINGUISHED BY AN UNUSUAL ATMOSPHERIC DISTURBANCE.

On the night of April 16th many of the pressure gauge registers in this vicinity showed a very decided rise and fall of pressure at about 11:45 P.M. In some cases the pressure fell first and then suddenly rose, while in others it rose first and then fell—the extreme variation was 16 tenths. At the same time the self-registering barometer at the Meteorological Observatory shows a corresponding disturbance in the atmospheric pressure.

In a number of cases street lights were extinguished in certain localities; but the disturbance seemed to be confined to a belt extending from the Oange Mountains, through Newark and Jersey City, across New York Island to Long Island.

It is important to record this fact, for the reason that it accounts for the extinction of street lamps, in this case at least, when, if it were not for the well-established fact of the atmospheric disturbance, it would have been very difficult to do so.

Some trouble has been taken to get some facts in this case, and we would be very glad to publish any further accounts of this matter that may have been noticed by any of our readers. It is easily understood that the pressure register is a most sensitive instrument, and the cards for the night of April 16th, in quite a number of cases, have been examined, with the following results:

In Newark, New Jersey, three pressure registers are kept by the Newark Gas Light Company, one at the works, one at the general office, about 3,600 feet distant, and one on what is called the high level 5,600 feet distant in a straight line. At the works there was no disturbance in the line of the gauge. At the general office the gauge line fell nine-tenths, and then rose again, while at the high level the line fell four-tenths, and then rose again. Many of the lights left burning low in offices and stores were extinguished, while in some cases the street lamps on one side of the street went out, and those on the other side, *fed from the same main,* did not. At Jersey City neither of the pressure registers at the works or the office showed any disturbance, while in the district midway between, many lights went out, and, in some cases, only those on one side of the street when both sides were fed from the same main.

In New York the gauges of the Harlem and the Metropolitan Companies, kept at the testing station at 79th Street, both showed a variation of pressure; but what is somewhat remarkable, while the Harlem gauge dropped seven-tenths, and then rose nearly as much above the average line, that of the Metropolitan Company first rose several tenths and then dropped below the line and recovered again. At the testing station at Grand Street, the gauges of the Mutual, New York and the Manhattan Companies all fell about ten or twelve tenths, and then rose above the line. The gauges at the Manhattan works were affected oppositely; the one at 18th Street and North River fell first and then rose, while the one at 14th Street and East River rose first and then fell.

In Brooklyn, at the Remsen Street office, the gauge went down about ten tenths and then up again. The lights in Williamsburgh, and also at the extreme south end of the city, went out in some places. This is accounted for on the theory that a small cyclone or whirlwind passed through the air, increasing the atmospheric pressure in some places, and decreasing it in others. It can easily be imagined that the most serious consequences might ensue if such freaks of Nature were of frequent occurrence.

STOKING BY MACHINERY.

There is probably no portion of the labor in the retort house to which more study and money have been devoted than to the development of some mechanical contrivance by which the exhausting and laborious work of drawing and charging the retorts by manual labor might be dispensed with. Even in the higher latitudes, or in the colder portions of the year, the severest tax upon the strength and endurance of the men is this heavy lifting and raking immediately in front of the heated benches. This work requires a peculiar class of labor, and one which has always justly received the highest wages; and in times of a disturbed labor market, it is not always the easiest matter to replace troublesome or dissatisfied men by others without impairing most seriously the working efficiency of the retort-house. So general has been the appreciation of this fact by all gas managers that anything that seemed to promise a chance of success has ever been hailed with delight; but while many have been the trials yet few have been the practical successes—after the test of time. In England the Foulis and the West machines have been more extensively used than any others perhaps; and of these, from recent official trials made at Manchester, the latter seems to have given the best results, although it is not entirely a mechanical stoker in the strictest sense of the term. By this we mean that manual labor is required to place the coal in the retort, and to withdraw the coke, although the labor is very much lightened by the assistance of the machinery.

The coal is first broken and elevated into a receiver by machinery, then the desired amount of it is taken in a hopper on the charging machine. This is brought before the benches to be charged, and, by proper appliances, a certain quantity of the coal is let into a small wagon standing at the level of the bottom of the retort which is then run into the retort, emptied and withdrawn beneath the hopper, again filled and emptied as before. In this way, each retort is charged in succession. The drawing machine consists practically of a frame-work on wheels, which is used to support the weight of the rake, which is operated by hand. The whole is very simple, and places the coal very evenly upon the bottom of the retort, and saves much time and labor, while the results obtained show better yield and candle power than the old method of working by hand. The Foulis machine is operated by hydraulic power, the coal is put into the retorts in scoops, and the coke withdrawn by rakes, both of which are moved by power.

A few years since a stoking machine was devised and built by Mr. Rowland of this city, and placed in the works of the New York Gas Company, where it operated efficiently for some time, and it was stated that it developed considerable economy over hand labor; but the use of the machine has been discontinued for some time. In many respects this was probably the most remarkable machine of the kind yet invented, and was a marvel of ingenuity, but its first cost must have been quite large, so that only the very largest works could afford to employ it, while the great mechanical accuracy with which it "functioned," necessitated considerable complication in the parts taken as a whole. What further development may yet come from it cannot be foretold.

But it would seem that from Cincinnati we are likely to receive the long looked for machine combining, cheapness, simplicity, and efficiency. A hopper receives the coal in the condition in which it is ordinarily used, and to the back of a "spout" at the bottom of the hopper is lead a steam pipe from a boiler or steam receiver.

The machine carries an upright boiler which supplies steam both for locomotion and charging. Having arrived in front of the bench to be charged, the hopper is adjusted in such a way that the spout enters the mouthpiece a few inches. A quick opening valve is opened and shut as quickly as possible three or four times in succession, and in five or six seconds the retort is charged as evenly and uniformly as if done by hand. The hopper is elevated or depressed by steam, and the next retort charged in a similar manner. In fact, the coal is blown in by steam at 50 lbs. pressure. The drawing machine is separate, although for small works, both might be placed on one platform and operated by one boiler. There are three rakes, one above the other, which may be used simultaneously when three retorts are all in one vertical line, but the practice is to use them in succession. This is a very simple machine, and is operated by one man, who stands at the rear with a lever in each hand, one of which raises or depresses the end of the rake, and the other is the throttle-valve that moves the rake either forward or back. The working capacity of the two machines is claimed to be one hundred and forty-four retorts every four hours, and as we have seen them draw and charge eighteen retorts in sixteen minutes, the claim seems a reasonable one. Each machine requires a man, while there is also required the necessary men to bring in the coal, take out the coke, and tend the fires.

While no comparisons can justly be made between these machines and any others, until they have been tested under identical conditions, yet it would *seem* that Captain A. Q. Ross, of Cincinnati, had taken a long stride in advance, and that perhaps these machines in gas making may yet take their place alongside of the reaping machine in agriculture.

If so, our only regret is that the field for gas making machinery is not so extensive as that for agricultural machines.

[From London "Journal of Gas Lighting."]

Pumping Gas at Beckton for Distribution in London.

During the last autumn there were erected at the Beckton station of The Gaslight and Coke Company—for pumping pure gas from the gasholders at that station to London, through the distributing mains—six of the largest exhausters hitherto made. These exhausters, or pumps, were designed for the purpose of utilizing to a greater extent than before the present two 48-inch mains between Beckton and the distributing stations of the Company in London, by increasing the pressure of the gas at Beckton as the demand required.

There are three engines, each working a pair of 250,000 cubic feet per hour exhausters, making the total quantity of gas pumped per hour equal to 1½ million cubic feet, and these have been in successful operation during the past winter. On some occasions as much as 1¾ million feet of gas per hour have, during foggy weather, been pumped for successive hours to London.

So satisfactorily have the engines and exhausters done their work, that very little comparative oscillation of water-gauge occurred at Beckton, and nothing perceptible at the distributing stations in London, where the gas was sent direct to the public.

The two mains under the ordinary holder pressure would deliver one million cubic feet of gas per hour to London, so that the economical advantages of forcing the gas by the means described are at once apparent, as without the aid of extra pressure, the necessary quantity of gas could not have been sent without laying, at a heavy cost, a third 48-inch main to London, and even then the gas would have reached town at a comparatively low distributing pressure.

It is believed that this is the first instance of gas being supplied direct to the consumers by pumping. The whole arrangement has worked so well during the past winter that the pumping power is about to be increased by one more engine and two additional exhausters, and these are now being made by Messrs. B. Donkin and Company. They are to be in operation before next winter, when the total nominal pumping power will be equal to two million cubic feet of gas per hour; and this quantity it is intended to force through the existing two 48-inch mains.

During the spring and summer months the gasholder pressure is sufficient to force the gas to London, and it is only necessary to work the above-named machinery during the winter months. Therefore steam engines of the non-condensing, single-cylinder type were selected. They are horizontal, of 40-horse power nominal, and three are already fixed. Each of them is fitted with a feed pump capable of supplying feed water sufficient to generate steam for the whole of the three engines. These engines also have a solid steel crank-shaft with double bearings, to which, by universal couplings, there are attached direct two of the 250,000 feet per hour exhausters one on each side, their slides being fixed at right angles. These couplings are so designed as to admit of either one of the exhausters being readily disconnected and laid idle, thus allowing the engine to drive only one exhauster. They also accommodate themselves to any unequal wear that may arise, which is an important provision.

The exhausters are on J. Beale's improved patent principle, with one slide instead of two, giving a greater bearing in the drum or axle, and greatly reducing the wear and tear. The nominal speed of each exhauster to pass 250,000 cubic feet per hour is 50 revolutions per minute, and with eight exhausters at work they would give the two million cubic feet of gas per hour as before mentioned. They have, however, been worked at sixty revolutions per minute and upwards.

The special feature of this gas-pumping plant is its unusual magnitude, the exhausters being larger than any yet made. The pumping or forcing of so large a volume of gas as 1¾ million cubic feet per hour direct through distributing mains to the public, with little or no perceptible oscillation of gauge, is also a novelty.

The problem having been so successfully solved at Beckton, it is a question how far the same means may be adopted in other gas works to supply gas through existing mains which have become too small for their work, by the increased and increasing demand for gas. In many works it may probably be worth consideration whether it would not be more economical to erect pumping plant similar in character to that we have been describing, rather than take up old mains and relay larger ones. This system might also facilitate new gas works being erected some little distance from large towns, and perhaps allow the choice of sites better adapted for the delivery of coal, etc.

Gas Inspection in Massachusetts.

The following law has recently been passed in Massachusetts:

COMMONWEALTH OF MASSACHUSETTS.

House, No. 322.—A.D. 1880.

An Act in addition to "An Act for the Inspection of Gas Meters, the Protection of Gas Consumers, and the Protection and Regulation of Gas Light Companies."

Be it enacted by the Senate and House of Representatives in General Court assembled, and by the authority of the same, as follows:

SECTION 1. The governor shall, with the advice and consent of the council, appoint an assistant inspector of gas meters and of illuminating gas, who shall assist in performing the duties of the inspector under his direction. He shall hold his office for three years from the date of his appointment, unless sooner removed, and shall receive a salary of twelve hundred dollars a year, to be collected and paid in the same manner as is now provided by law for the salary of the inspector. He shall be subject to all the conditions, disabilities, and responsibilities now imposed by law upon the inspector, except that the amount of the bond to be furnished by him shall be two thousand dollars.

SEC. 2. The inspector and his assistant shall be paid, in addition to their salaries, all actual traveling expenses necessarily incurred by them in the performance of their duties, the amounts to be collected and paid in the same manner as is now provided for said salaries.

SEC. 3. No meter shall be used for measuring gas supplied to a consumer unless it be sealed and stamped in the manner required by law; and for every meter not so sealed and stamped in use after July first, eighteen hundred and eighty, a fine of five dollars shall be paid to the city or town where such meter is situated by the gas company supplying the same.

SEC. 4. Every gas light company annually manufacturing more than 15 million cubic feet of gas shall provide a suitable room, at least a quarter of a mile from the gas works, containing a disc photometer of a construction approved by the inspector; and this room shall be open to the inspector and his assistant every working day from eight A.M. to six P.M.

SEC. 5. The gas of every company supplying more than fifty consumers shall be inspected at least twice a year, and one additional inspection shall be made for every four million cubic feet of gas supplied by each company; *provided*, that the gas of no company shall be inspected oftener than once a week. All such inspections shall be made by the inspector or his assistant, and one-fourth at least of all such inspections shall be made by the inspector. The gas shall be tested for illuminating power by means of a disc photometer; and during such test shall be burned from the burner best adapted to it which is at the same time suitable for domestic use, and at as near the rate of five feet per hour as is practicable. Whenever the gas of any company shall be found on three consecutive inspections to give less light than fifteen standard English candles, or to contain more than twenty grains of sulphur or ten grains of ammonia per hundred cubic feet of gas, or more than ten per cent. of carbonic oxide, or any sulphuretted hydrogen, a fine of one hundred dollars shall be paid by such company to the city or town supplied by it; but no fine for any impurities found before the first day of September, eighteen hundred and eighty, shall be imposed. Whenever, during the test, the consumption of gas shall vary from five feet per hour, or the candle from one hundred and twenty grains per hour, a proportionate correction shall be made for the candle power.

SEC. 6. Section seven of chapter one hundred and sixty-eight of the acts of eighteen hundred and sixty-one is hereby amended by inserting after "apparatus" the words "and chemicals."

SEC. 7. Sections six and ten of chapter one hundred and sixty-eight of the acts of the year eighteen hundred and sixty-one are hereby repealed.

Suffocated by Gas.

Following quickly upon the extraordinary case of gas poisoning at the New York Hotel, by which two Englishmen nearly lost their lives, comes another story from No. 115 East Twenty-second street of an almost similar catastrophe, the difference being that in this case the result was fatal. John Donovan, a native of Ireland, aged 48, arrived in New York on Thursday last on his way to visit some friends in New Jersey. He stayed at the house of Mr. and Mrs. Henessey, at No. 115 East Twenty-second street, where he occupied a hall bedroom. On Thursday evening he went out to see some friends, and returned early, retiring at eleven o'clock. At half-past eight o'clock the next morning the servant went to awaken him, and gaining no response to her repeated and vigorous knockings, she ventured to try the door. It was unlocked, so she decided to go in and arouse Mr. Donovan. Entering, she was almost stifled by the rush of escaping gas. She flew to the window and threw it open, and tried for and instant to arouse Mr. Donovan, but without success. She then gave the alarm to Mr. Henessey, who immediately summoned Dr. Trafford, of West Twenty-second street. The latter, with the assistance of Dr. S. A. Westcott, of No. 360 Bleecker street, applied every restorative that was suitable to the case. Even an electric battery was used, but with no success. Only once, at about six P. M. on Friday, did the patient show any sign of rallying, and then it was for a short time only. He remained utterly unconscious from the time he was discovered, half-past eight A.M. on Friday, till eleven o'clock on Saturday morning, when he expired.

A coroner's inquest was held yesterday, and a verdict returned that the deceased died from an overwhelming of the nerve centres and congestion of the lungs, caused by gas poison.

The hall bedroom he occupied was 14 feet long by 6 feet wide, and 8 feet high. It contained one gas bracket. There are only two theories as to the escape of gas, one being that Donovan blew out the flame, and the other, that after turning it off he touched the stopcock inadvertently and turned the jet on again, the stopcock being extremely loose, and turned by the merest touch. The man's relatives are expected in the city to-day. He was a wheelwright, employed in Chicago, Ill.—*N. Y. Herald*, May 3.

[From the "London Journal of Gas Lighting."]

Manchester District Institution of Gas Engineers.

Mr. J. G. Hawkins (Wigan) read the following paper on

GAS PURIFICATION.

It is unnecessary for me to point out to you the importance of the subject which I have the honor of bringing before you this afternoon, or to impress upon you the serious consideration it deserves from all those connected with gas manufacture. The subject I have chosen for my paper is that of the "Purification of Coal Gas, and the best means whereby the same may be accomplished"—a subject which has perhaps had more attention given to it than any other branch of our profession.

Even in the early days of gas making it was considered exceedingly desirable that the gas should be purified previous to its being sold to the consumers; but what was considered pure gas in those days would be regarded as far different to-day. Parliament has stepped in from time to time since then, and imposed certain restrictions dealing not only with the purity, but also with the illuminating power of the gas supplied by the manufacturers, and in the event of default in either of those particulars, the manufacturers lay themselves open to heavy penalties. Indeed, it is only by comparison of the present system of purification with that of the past that we can arrive at any idea of the real progress we have made in this particular branch of our business. Only a few years ago the material used for purifying gas was exclusively lime; since then this material has given place to oxide of iron, partly on account of its cheapness, and partly because it creates less nuisance to the public when taken from the purifiers. Attempts have also been made to effect purification in closed vessels, so as altogether to avoid changing the purifiers; but, as far as I am aware, they have not yet proved successful.

I have given the question of gas purification a considerable amount of attention, especially within the past few years, and the result of my experience has been such as to satisfy me that in this particular respect there is still much room for improvement, even in the best managed gas works. It has been said that purification does not begin in the purifying house. This is no doubt perfectly true, and I am convinced that with a proper sized main from the hydraulic, together with sufficient condensing and scrubbing power, the only need we have of the oxide or lime purifiers at all is to give to the gas, if I may use the term, just a finishing touch.

Previous to the extensions that have recently been made at the Wigan gas works, at a time when the annual make of gas was about 200 million feet, it was no uncommon thing for us to be compelled to change daily two and three purifiers, each 20 ft. square by 4 fit. 6 in. deep, and even then it often happened that our gas was anything but satisfactory. The fact was the purifiers were being called upon to do an immense amount of work that ought to have been done before the gas reached them at all, and in consequence of this they were rendered totally unfit to perform what I contend is their only duty—viz., to act as catch purifiers pure and simple. As soon as I had completed the extensions, a part of which consisted of larger mains from the hydraulics to the condensers, larger condensers, and two new scrubbers 60 ft. by 12 ft., it was found that instead of changing purifiers twice or three times a day, as we had been in the habit of doing, once every fortnight was quite sufficient. This caused me to proceed a little further with my investigation. I first shut off one scrubber, and in a short time found that it gave the purifiers about 25 per cent. more work to do than before. I then shut off a portion of the condensers, which gave an additional 10 per cent., and so on; in proportion as I reduced or increased the

amount of condensing and scrubbing power, so the amount of work thrown upon the purifiers varied.

Seeing, then, how very little the purifiers had to do when the scrubbers, condensers, etc., were in full work, I decided to pull a sufficient quantity of air at the inlet of the exhauster as would keep up a constant revivification of the oxide purifiers; but, owing to the deleterious effect it had on the illuminating power of the gas, it was discontinued. After a time, however, I tried the effect of pulling air at different points in the condensers, thinking perhaps it might take up and retain some of the naphtha vapors and light oils so abundant at that point. This, to my great satisfaction, proved to be the case, and it has been in this manner that the whole of the gas made at the Wigan works from the seventh of May last year to the present time has been purified. Not a single trace of SH_2 has there been in our gas during that period, except on two occasions, when we commenced to use a fresh supply of oxide of iron, and then it was only very temporary indeed; neither has the gas been below our parliamentary standard, viz., 18 candles, which I wish to state has been maintained from a mixture of ordinary Wigan Arley and four-foot gas coals exclusively.

On the 27th of October last, nearly six months from the time of its being first charged, I opened one of the purifiers to ascertain its condition, and to my astonishment I found that the oxide had become one solid mass. How the gas found its way through it I cannot imagine; suffice it to say that the aid of a pickaxe and heavy crowbars had to be brought into requisition before it could be taken out. This purifier was in due course recharged with fresh oxide, and in turn the others were examined, cleaned out, and recharged in a similar manner. On subjecting to analysis the material taken out of the purifiers, I found it contained no less than 72.20 per cent. by weight of sulphur, which has since been verified by another analysis made by Messrs. M'Dougall Brothers, of Machester. I have brought a sample of the material with me, and it may be examined or tested by any person wishing to do so.

In order that I might be enabled to ascertain the exact quantity of air required to keep the oxide of iron in good working condition, I attached a small meter to the condensers, and by drawing the air through it I found that 4¼ cubic feet per 1000 feet of gas, or 0.45 per cent., was sufficient.

This system of purification does not in the slightest degree affect the present method of taking out carbonic acid, bisulphide of carbon, or any of the other sulphur compounds, inasmuch as the combination of the oxygen with the oxide only takes place after the sulphuretted hydrogen has converted into sulphide of calcium the lime used for extracting these impurities.

In conclusion, I have to thank you for the kind attention you have given to my paper, and to express a hope that, if there are any points upon which you wish further information, you will kindly say what they are, and I will endeavor to explain them.

Discussion.

The Vice President (Mr. J. Chew) said he wished to put a few questions to Mr Hawkins. He should like to know, in the first place, whether he understood him to say that oxide of iron was exclusively used in the purifiers he had most recently constructed.

Mr. Hawkins replied that they used nothing whatever but oxide of iron.

The Vice-President said, that being so, he should like to know what became of the fumes of sulphur, if there were any, during the process of revivification. Was the gas ever tested for sulphur other than sulphuretted hydrogen, and were the Corporation bound by their Act to remove any of the other sulphur compounds not removed by the oxide of iron? At the present time one of the most important matters in connection with gas manufacture was how to avoid causing a public nuisance. The presence of carbonic acid would reduce the quality of the gas. The London companies had been tied down very strictly, and had been obliged to resort to lime purification. He should like to know whether Mr. Hawkins had tested for carbonic acid and bisulphide of carbon, and what was the outcome.

The President said all these queries might be put in the course of the discussion, and Mr. Hawkins would no doubt answer them.

Mr. Paterson said the idea developed in the paper was certainly a new one, and, he thought, claimed very important consideration. If by the process adopted by Mr. Hawkins the expense attending the removal of oxide for the purpose of revivification could be avoided, and the same result be obtained by passing a current of air along with the gas, it certainly upset some of their previous notions. He did not know, however, whether it would not tend to destroy the illuminating power of the gas. They all knew very well that if they mixed air with gas they destroyed the illuminating power; but in this case the air had to pass through the oxide, and possibly the affinity they had for each other would keep up a system of oxidation. He did not see that any ill effects could be produced by liberating the sulphur. The question of carbonic acid was a different one. He believed they could not, by the ordinary process of purification by oxide, take out the carbonic acid. In order to do so they must pass it through some other purifier, because oxide had no action upon carbonic acid. If it was true that Mr. Hawkins process produced the results claimed for it, he (Mr. Paterson) considered it a very important fact, and one that would result in a large saving of expense.

Mr. Hunter (Salford) said the idea was certainly very striking, and they accepted Mr. Hawkins' statement that such was the fact. It seemed to surpass their chemistry for the present moment, and it was for them to dwell upon it and work it out in experience; and if they found it the same in practice, it would be a very important discovery for them. He agreed with Mr. Hawkins with respect to making the condensers and scrubbers do the work of purification, and it quite accorded with his own experience. They had heard a great deal about carburetted gas. This seemed to be carburetting in the other extreme—introducing the air to take up naphtha and other gases. He had been to see the apparatus at Rochdale, and he thought it might be of some interest if he stated what had been his own experience. It happened that in the alteration of their Regent Road works he was able to pass the liquid products direct from the hydraulic main to the tar wells by the old pipes, while by the new pipes he allowed the products and the gas to pass together. He gained some new experience by these methods. By watching the temperature at which he kept the gas, tar, and liquor together, and taking great care that the separation took place at a given point, he found a certain increase in illuminating power. As to how Mr. R. H. Patterson arrived at the opposite result, he could not explain. He could only say what his experience was. He carefully watched the result himself, with the aid of his assistant. It was not hours, or even days of casual watching, but an elaborate test. It was a subject that would come to the front before long, and they would have to seriously consider it, and he believed they would find that the adoption of the Rochdale system or of Aitken and Young's process would be necessary. The idea in his mind was that if they could keep the gas from contact with the sooty matter in the tar, and simply carry the light oils, they would get a great increase in the illuminating power. If they only put in the naphtha and benzol, and left out the pitch or sooty matter, there was no fear of its being reduced—it became permanent gas.

Mr. Newbigging said that a few months ago he had the pleasure of traveling some miles with Mr. Hawkins, who described this process of his. He (Mr. Newbigging) was very much struck with it, and strongly urged Mr. Hawkins to write a paper on the subject, and read it at one of their meetings. He therefore took some little credit to himself for having induced the author to prepare and read his most valuable communication. The idea of revivifying oxide of iron without changing the purifiers was not, however, a new idea. Most of them would remember that Mr. Fish, formerly of Hornsey, and now of Bucharest, in Roumania, discovered that by driving a jet of steam through the purifiers—the steam, of course, drawing a certain quantity of air with it—he was able to revivify the oxide of iron in the purifiers when it became foul. The steam was also found very useful in preventing the oxide from becoming unduly heated and liable to fire, and it produced the degree of dampness required in the purifying material. It had also been attempted in some of the gas works in the Metropolis to draw in air through the material *in situ*, by connecting the purifiers by means of a pipe with the chimney, the draught of which was sufficient to cause the air to enter the vessels by another opening, and permeate the mass of material, thus effecting the same object. In neither of the arrangements, however, was the air allowed to mix with the gas. The failure of these plans was due principally to two circumstances—viz., the liability to firing, thus destroying the wood grids, besides being otherwise highly dangerous; and also to the consolidation of the material, causing heavy back pressure. The difficulty in both cases arose from the large amount of air introduced. Mr. Hawkins had succeeded in discovering the right quantity of air necessary, and applying it at the right place, that was at the end of the condenser, mixing it with the gas. He thus introduced one impurity for the sake of eliminating another, and this was a well understood principle; as, for instance, in the case of sulphide of calcium arresting the bisulphide of carbon. But the curious circumstance in connection with the process was that by the means described Mr. Hawkins was able to get a much larger proportion of free sulphur in his oxide of iron than it had been possible to obtain by the ordinary means of charging the purifiers. He believed about 56 per cent. was considered the limit that could be reached; but Mr. Hawkins had been able to put in 75 per cent., and it was a question whether even then the oxide could be considered fully saturated. Another remarkable thing was the consolidation of the material. Though the stuff was almost as hard as a piece of stone, yet it seemed to be quite efficient in purifying the gas. It was now well known, since Mr. Forstall had made it plain, that when lime in the form of nodules was used as a purifier, it was much more efficient than in the form of flour. The gas seemed to penetrate right to the centre of each lump, whilst it passed through the flour without

being affected. Perhaps something of the same action resulted in the case of the oxide of iron by Mr. Hawkins' process. By the adoption of this method of revivifying, it might be possible to dispense with the fourth purifier in a series; or, at least, the whole four might be employed without any of them standing off, except on rare occasions.

Mr. T. O. Paterson (Rochdale) considered this a great discovery, as it certainly was a most curious one. He had had some experience in trying to revivify the oxide at Rochdale by a steam blower; but they had the same difficulty to contend with that Mr. Newbigging spoke of—the heat. The oxide would not revivify with all their trials, and the wooden grids in one instance caught fire. He believed the blower was too small for the size of the purifiers.

Mr. Hunter (Salford) suggested that it was perhaps too large, admitting too much air.

Mr. Legge (Ossett) would like to ask Mr. Hawkins what was the amount of back pressure that he had on his purifiers. He thought it must be very great.

Mr. W. Bridge wished to know whether this was not a similar system to that which had been in operation at Longton, in Staffordshire, for ten or a dozen years.

Mr. Mitchell (President of the West of Scotland Association of Gas Managers) looked upon the subject as of very great importance to gas engineers, and he thought Mr. Hawkins had mentioned a fact which was worthy of their most serious consideration—which was, that the scrubber and condenser should be of sufficient area and capacity to treat the quantity of gas introduced. He could corroborate his statement as to the quantity of gas purified under these conditions. At the new works which he had recently erected they had saved over eighty tons of lime in eight months, purifying about 28 million cubic feet of gas, as compared with the quantity which they used for a similar amount of gas at the old works. He did not think the pressure was increased in proportion to the depth of material employed. The lime was 32 inches deep, and he put it in one sieve, and did not find that there was above one-tenth or one-tenth and a half of extra pressure. The admission of air as a purifying agent was certainly a new feature. He had never imagined that air would have a beneficial effect upon oxide of iron in the way it was employed by Mr. Hawkins; but he thought there was something in it, because there was a possibility that in passing through the apparatus the air would become carburetted.

Mr. Eastwood (Batley) wished to ask Mr. Hawkins if he had tried the effect of drawing air in nearer the hydraulic main than the condenser. It seemed to him that if it were drawn in where the gas was hotter, it would have a better chance than at the condenser end.

Mr. Storer (Stafford) said that some years ago they altered their method, so that it enabled them to convey the gas and tar and the liquor together from the hydraulic main a considerable distance to the entrance to the condenser. Previous to that arrangement, with the same coal and the same setting of retorts, they were troubled with naphthaline to a great extent; but since then it had never troubled them. Their condensers were horizontal, and there were a washer and scrubber—not very large, only about 30 feet high—and, with thorough condensing and washing and scrubbing, they had a very small quantity of carbonic acid, and could purify 2½ million feet of gas with the same material that they formerly used for 1 million feet. He thought the paper a very valuable one. If notice were taken of the different temperatures of washing and scrubbing, and if there were only sufficient power, it would be found, even though it might not be possible to revivify the oxide in the purifiers, that there would not be so much required to purify. He used Arley coal with a mixture of North Staffordshire, and the illuminating power of the gas had not been below sixteen candles.

The President regarded the paper as exceedingly suggestive. It took one a little by surprise as to the result, though he could not agree with the statement that it was new, because it was something he had tried several times, and it was not an original idea of his. He knew perfectly well that where oxide was used for purification it was quite safe to draw in a portion of air if the oxide was good. Air was objectionable when mixed with gas, only on account of the oxygen it contained. They might have something like 3 per cent of carbonic acid in the gas, and yet have comparatively little difficulty in maintaining the illuminating power at 17 or 18 candles. If they had 3 per cent. of air, it would destroy nearly the whole of the illuminating power. They came to the conclusion, therefore, that it was objectionable, as increasing the combustion to such a rapid extent that the carbon had no chance to remain suspended sufficiently long to become luminous. Nitrogen had not the same effect, and if they extracted the oxygen air became simply a diluent. They, however, had no idea of carburetting the air—although it was admitted at the hydraulic main—but did it simply for the purpose of prolonging the time that the oxide should remain in the purifiers. When the gas got above a certain standard, they, in order to sail as close to the wind as possible, reduced the illuminating power in this way, and at the same time, as they thought, prolonged the duration of the oxide by driving in the air. They, however, arrived at nothing like the result mentioned by Mr. Hawkins, and it was on this account, he thought, they were indebted to him, because it opened up the prospect of a large improvement in the manufacture of gas. As to the question asked by Mr. Chew with reference to sulphur compounds apart from sulphuretted hydrogen, Mr. Hawkins would have to admit that he did not test for these. There was no doubt at all that two things were required in order to accomplish such a result. One was that the purifiers must be very large, so that not only would purification go slowly on, but that the revivification might have plenty of time. The question asked by Mr. Legge was one that suggested itself to him. He very recently tried to get the oxide as dry as possible, and it became so dry that it was difficult to pass the gas through it, the back pressure was so great; but if the oxide were put in under ordinary conditions, light and moist and open, and began to petrify, if he might so term it, in that state, all the pores would be open, and would remain so until they became filled by the precipitated sulphur, and the oxide had to be replaced by other. In large purifiers the pores would take a long time to cake up, so as to give a large amount of back pressure. He did not know whether these suggestions could always be carried out. He should fancy that Mr. Hawkins' coal did not produce very much sulphuretted hydrogen, or he could not have kept the oxide in for so long a time. Mr. Paterson said it was very free from sulphur, and he (the President) should imagine that it was. Where there was a large quantity of sulphur in the coal such a process could not be carried on; besides, they must have an exceedingly large area in order to reduce the flow of the gas to that degree of slowness at which it was necessary the work should be done.

Mr. Hawkins, replying to the various points raised, said he did not quite catch the meaning of Mr. Chew's question with reference to the fumes of sulphur.

Mr. Chew said his impression was that the air was not passed in along with the gas.

Mr. Hawkins said it was allowed to pass in along with the gas. He did not profess to take out the bisulphide of carbon, but at Wigan they did more washing with ammoniacal liquor than formerly. They washed a great deal with this material, and they had one scrubber through which clean water was passing. They found great benefit from it in reducing the sulphuretted hydrogen and other impurities. There was certainly some little back pressure, and that was the reason why he looked into the purifier, and found the oxide in the state he had described.

Mr. Newbigging—How long had it been at work?

Mr. Hawkins—From the 7th of May last to the 27th of October. They were now working on the same process, and had had no change for a long time.

Mr. Paterson—What was about the back pressure you had?

Mr. Hawkins—About 16 inches.

Mr. Newbigging—What is about the normal pressure?

Mr. Hawkins—Six inches.

Mr. Clarke—Is the 16 inches on the purifier alone?

Mr. Hawkins—Sixteen inches from the holder to the exhauster.

Mr. W. Chew (Blackpool) read the following paper:

THREE MONTHS' EXPERIENCE OF ELECTRIC LIGHTING AT BLACKPOOL.

Under this heading I propose to place before you some particulars of the mode of laying down, together with the capital cost and working expenses of the electric light plant erected last year in our town, feeling sure that it will be of interest not only to yourselves, but to the gas world generally, inasmuch as it is the only town in which electricity has been tried to the best advantage, and on a practical working scale.

In the beginning of August last year our town council unanimously agreed to light up the central portion of their extensive Promenade, which has a sea frontage of three miles, by means of the electric light, in a manner surpassing anything that had ever been attempted before; this system of lighting to be employed every season during the autumn months, and on days of festivity. The opening day was to be the 18th of September, and I may here say that they have accomplished their object of having created a sensational light.

The committee appointed, together with my father, their gas engineer, they proceeded to inspect at once all the best known systems, viewing, among others, the well-known Thames Embankment lights; but so thoroughly satisfied were they that in all these there was nothing but what some large gas lamps would supersede, that they resolved to strike out the rather bold experiment of having large centres of lighting, and employing four naked lights of 6000-candle power on the Promenade, and one on the end of each of the two piers. The area to be illuminated was therefore a quadrangle, 1000 yards long and 400 yards wide. The four lights on the Promenade are 350 yards apart, and those on the pier about 400 yards from the shore

The whole are placed in plain glass lanterns 60 feet above the level of the roadway. This is necessary with naked lights, so as to remove the strong penetrating power from the eye when approaching the lamps, as well as to better distribute the light between them.

Having briefly described the object desired to be accomplished, I cannot do better than explain the mode of procedure adopted to produce the effect. Arrangements having been come to with Messrs. Siemens, of Charlton, near Woolwich, for the supply of the necessary electric apparatus, and with Messrs. Robey & Co., of Lincoln, for the engines, and the whole of the plant being under the control of the Gas Department, it became part of my duty to superintend its erection, and to see to its working after the contractors had completed.

The site selected as being convenient for the machinery was the Corporation Depot, situated 400 yards from one end of the Promenade and 250 yards inland. Here was put up a substantial timber building, 60 feet by 25 feet, and inside, on the ground, was laid a framing, which formed the foundations for the machinery, the interspaces between the timbers being filled in flush with concrete, and then boarded over to prevent dust rising. Upon this were fixed, as they arrived, two portable 16-horse power engines and boilers, and at the opposite end were the electric machines, of which there were seven, all being driven from a counter-shaft placed between them and the engines. From each of the six machines a distinct wire is led to its own lamp, and one common return wire, so to speak, answers for the whole. You will no doubt wonder what the odd machine was for. Well, at first, the whole of the six machines had to perform the duty of producing their own electricity, but that duty is now taken from them by specially devoting a dynamo-electric machine to that purpose solely, and this was found to be better for the lights.

The first difficulty we had to contend with was the laying of the wires inside the 2-in. and 3-in. cast iron pipes, it having been decided to place them underground, hidden from view. This proved no easy matter, inasmuch as the wire was in 500-yard lengths, and it was desirable to have as few joints as possible. It therefore cost as much to put the wires through as it did to make the trenches, so careful had we to be in order not to damage the insulation, and to keep off the water. The weather happened unfortunately to be unfavorable for us, as, a day or two after commencing, a series of high winds set in, with their usual effect at Blackpool of forcing the water over the Promenade, to the amusement of visitors, but to the detriment of our work, for at every tide it filled the trenches and pipes with sea water. However, as there was no time to stop, we persevered, and completed the 1500 yards in the week allowed us, and were ready for the preliminary trial to take place on Saturday, the 13th; but, alas, all our effort were unavailing, for the insulation of the wires had yielded to the water, and it was quite spoiled for the purpose, so there was no alternative but to withdraw them. This we commenced on the Friday evening, and drew out the whole and laid them on the arms of the lamp posts. By the Saturday night we had temporarily connected the wires, and had two of the most commanding lights at work with good effect. By the following Monday morning we had collected together the most suitable poles in the town, and immediately set to work and placed them up telegraph fashion, and secured the wires thereto with iron staples, there being no time to get insulators fixed. During the time the wires were being completed, experiments and trials were going on in the engine room, and by Thursday, Sept. 18, all was finally ready and the lights were lit at dusk with remarkable steadiness, considering the drawbacks we had to encounter for want of time.

I may tell you that it was with no small degree of pleasure I beheld, from an elevated position, the lights shedding down there bright white beams on the upturned faces of at least 70,000 persons who had come to Blackpool to witness the grand spectacle—to see the poor gas once for all annihilated. Well, I must say the gas cut a sorry figure when burning in the lamps when the electric lights were lit, of which a good many of you present were eye-witnesses; but it came very useful as the nights grew darker, and one of the new illuminants was suddenly extinguished, for it would have been unsafe to the public to have left all in darkness, which might have occurred at any moment.

As we got more accustomed to its eccentricities and freaks of going out every now and then, we gained confidence, because we found out how to apply the remedy. In nine cases out of ten the cause was the rack holding the carbons getting fast, and a man was usually on the lookout to shake it with the line to the lamp. So frequently did this happen that ultimately the passing public and youths saved us the trouble by merely pulling the line as they went by. Sometimes, however, more serious mishaps would occur, owing to the exposed position of the lights, and to the strong gales of wind and rain The delicate working parts were affected by corrosion and damp, and in such cases there was no alternative but to take the lamp in for readjustment; so it had to remain extinguished for the night, or if it was a very bad light, it was better policy to shut it off. One would naturally say, why not take out the spare lamp and substitute it for the other? This seems very simple until explained. The reason is this, that owing to all the circuits being of different lengths, and having different resistances, each lamp had to be accurately adjusted and tried in the test room, with the current flowing all through the wire. Thus, supposing No. 1 lamp went out and could not be got to work again; it is 1400 yards away, and it would be necessary to send two men to lower it, couple the two wires together, bring the lamp back, and set to work adjusting the spare lamp to the circuit, which would require say, half an hour; then to send it back and hoist it up, the whole occupying 1½ hours, during which the light would be out, and would need another attendant, who would afterward have nothing to do, and some nights would never be wanted, although he must be always at hand.

The mode of working which we have found to be the most advantageous is the following: One engineman and assistant look after the engines and boilers, which require very great attention in their stoking, for a variation of 5 lbs. pressure of steam will throw all the lights out of order. Another man is kept to oil the machines and keep all going right in that department, as well as to look for any light going out, which in some cases instantly shows itself at the machines, but always at a dial board, on which all the connections are made, and on which we have suitable tell-tale appliances. The hour for starting work is one o'clock P.M., and then the mode of procedure is as follows: All three men start out and fix the carbons in the lamps, clean the same, and hoist them up again. To go the whole round occupies 2½ hours, if all is well. Occasionally a carbon holder is burnt away, the lamp having burnt to hard on a windy night, and this the men generally refit with a spare holder they take with them. On these occasions 3 hours is about the proper time. They next return to the machine room, clean the engines, and go carefully over the machines and belts, and then all is ready for lighting, which generally lasts five hours. We should have to go round the lamps a second time if we had to light all night; this would entail another staff, and be very expensive.

I myself attend almost every evening at the Depot during the period of lighting, to see that all is kept right, and to put in proper order all the lamps brought in, as well as to instruct the man in any repairs and alterations to be made. It is also very requisite to go round two or three times a week to see the carbons fixed in the lamps, and to adjust them a little to see that the current is working the right way through the lamp.

Having given you a good idea of the work to be done, I think I could not do better than proceed to give you a few particulars of the cost of all this, and I will put our system in comparison with the others, so that you may see the proportion of the costliness between large lights and the small ones, comparatively speaking—those of the divided current, or Jablochkoff system. The following figures [see next page] will show the amount of the capital account. Those of Westgate-on-Sea and the Thames Embankment are from the reports of Messrs. Bennett and Valon, and of the Metropolitan Board last May, but to the latter I have added the apparatus which I find necessary to work their plant permanently, and this enhances the capital. Each item that is added is marked with an asterisk (*). It must be noted that the apparatus at Westgate was only temporarily fixed.

Now, it is very difficult to put the proper interest to these tables, inasmuch as the longer the lights are burned, the less is the cost per hour; but as I must compute it in some way, so as to arrive at the actual cost, I shall take our own as we intend to use it, or I will give it the benefit of being lighted every night during which our gas lamps are alight—viz., 240 nights—and allow them to burn from 5 to 5½ hours. Any other deductions you wish can be made accordingly. In the following table you will note that we have two engines and boilers, and during the last week we kept the plant going with only one running; therefore we shall compare favorably with others in having reserve power, which is far better for working steadily and safely, and I may say it would be very necessary to have other parts of the plant in duplicate if we were working under penalties for not keeping up the illuminating power, and were fined heavily for occasionally leaving part of the town in darkness.

Before closing my paper I will say a word or two on some of the effects which our lights have produced in different states of the atmosphere, and conclude with a few remarks on electric lighting generally as an illuminant for our cities. The four lights as now placed light up the Promenade at Blackpool very well for a length of 1500 yards, but not evenly, there being a flood of light directly under them, and not so much midway between them, though amply sufficient for any requirement. If there had been six lights on this length the effect would have been uniform throughout. As comparing the diffusability of the light under various conditions, the best result I have noticed particularly has been on some nights when I have been able to read the time very readily by my watch at a distance inland of about 1½ miles. This effect, I am of opinion, was caused by the reflection of some passing rain clouds, which I noticed hanging about in large masses pretty low in the atmosphere.

Capital Account.

Blackpool. Six Lights=36,000 Candles available.				Westgate. Six Lights=1182 Candles available.				Thames Embankment. Twenty Lights=4000 Candles available.			
Two 16-horse power engines and boiler, with reserved power	£598	0	0	One 10 horse power engine and boiler	£300	0	0	One 20-horse power engine and boiler, with reserved power	£495	0	0
Counter-shaft	52	0	0					Counter shaft	20	0	0*
Coating	13	0	0								
Seven machines (Siemens')	800	0	0	Two Gramme machines	220	0	0	Two Gramme machines	360	0	0
Seven Siemens' lamps and six lanterns	143	0	0	Six Jablochkoff lamps, complete	60	0	0	Twenty Jablochkoff lamps, complete	200	0	0*
Terminals	12	0	0	Terminals, etc.	2	0	0	Terminals, etc.	5	0	0
Belting	60	0	0	Belting	4	0	0	Belting	35	0	0
8800 yards of cable	556	0	0	1200 yards of cable	110	0	0	3900 yards of cable	390	0	0
Posts and poles	40	0	0	Six lamp posts	12	0	0	Twenty lamp posts	40	0	0*
Engine house	200	0	0	Engine house	300	0	0	Engine house	300	0	0*
Foundations	60	0	0	Foundations	10	0	0	Foundations	50	0	0*
Gas and water fittings	9	0	0	Gas and water fittings	9	0	0	Gas and water fittings	9	0	0*
Strophometer	10	0	0	Strophometer	10	0	0	Strophometer	10	0	0*
Velocimeter	2	0	0	Velocimeter	2	0	0	Velocimeter	2	1	0*
Tools	10	0	0	Tools	10	0	0	Tools	10	0	0*
Galvanometer battery and leclanche	5	0	0	Galvonometer battery and laclanche	5	0	0	Galvanometer battery and leclanche	5	0	0*
Ropes, tackle, stays, etc.	30	0	0								
Labor erecting and sundry bills	200	0	0	Labor erecting and sundry bills	46	0	0	Labor erecting, and sundry bills	69	0	0*
Total	£2800	0	0	Total	£1100	0	0	Total	£2000	0	0

Below I will compare the working expenses we are now at, and those of the others for one night of 5½ hours:

Blackpool. 36,000 Candle Power.				Westgate. 1182 Candle Power—Four Hours Lighted.				Thames Embankment. 4000 Candle Power.			
One engineman	£0	5	0	One engineman	£0	5	0	One engineman	£0	6	8
One assistant	0	3	4					One assistant	0	6	8
Attendant and supervision	0	7	0	Attendant and supervision	0	7	0	Two assistants	0	10	0
Oil, tallow, turps, etc	0	1	6	Oil, tallow, turps, etc.	0	0	5	Oil, tallow, turps, etc.	0	1	7
Water for boiler and general use	0	0	6	Water for boiler and general use	0	0	2	Water for boiler and general use	0	0	2*
Gas	0	0	6	Gas	0	0	6*	Gas	0	0	6*
Carbon, with waste, 10 feet at 9d	0	7	6	24 candles at 8d., 16s. 3d; dropped to 2d	0	4	0	20 candles, each lasting 1¼ hours=80 candles, at 2d. each	0	13	4*
Fuel, coke, and coal, 13 cwt. per night.	0	6	6	Fuel, coke, and coal	0	6	0	Fuel, coke, and coal	0	4	9
Interest at 5 per cent	0	11	8	Interest at 5 per cent.	0	4	7*	Interest at 5 per cent.	0	8	4*
Repairs and maintenance, 10 per cent.	1	3	4	Repairs and maintenance, 10 per cent.	0	9	2*	Repairs and maintenance, 10 per cent.	0	16	8*
Total	£3	6	10	Total	£1	16	10	Total	£3	8	8

The same thing has been of particular benefit to some of the fishermen, who have had to go out on the sands about two miles away, at night time, to take fish, and they have many a time been able to see distinctly. The opposite effects are produced in a dense fog. I have only been able to see the lights at a distance of 100 yards, and I could see at the same distance one of the large 100-candle gas lamps we have fixed in another part of the town, owing to the difference in the color of the light.

The strong concentrated light of an electric lamp is very bad for the eyesight, and I would not recommend anyone having a weakness in that direction to look at them. I myself, as well as the men employed, have had painful experience of the result, although at the time we were unconscious we were being affected. While experimenting with the lamps it is not noticeable, but on leaving the room the effect is severely felt, and if badly affected there will be no sleep for you that night, but you will have to sit up and keep the eyes wide open and shaded from light, as it is impossible to shut them, so painful are they. This result has been produced, though in a less degree, in the case of a great many who have visited the room to see the mysterious apparatus at work.

The grand idea of the divisibility and distribution of electricity in the same manner as gas or water—viz., having large leading wires or mains running through the principal streets, with small branches to each consumer—has not for a moment been entertained by any of the electricians, though this is the plan the anxious public are waiting for; the reason being that you cannot have a storage for your supply, as with gas, where you create a large reserve, and, charging all your pipes under pressure, leave those who require it to simply turn on an outlet for the supply, and, by the grand old law of gravitation, they get all they want from the stock, while a fresh supply would be making and storing for next day in the gasholders. Not so with electricity. As it is generated, so it must be consumed; for electricity must move in a circle, otherwise it cannot be created, and as it moves it disappears. The same electricity does not move round again; it never passes the starting point, but as it comes it dies, and makes room for more.

Now, as it is impossible to store electricity in any appreciable quantities, we see that the object must be to utilize its power as it is being generated; therefore the greatest difficulty is in the distribution as produced. This will be found a great disadvantage, assuming that a town is to be supplied, for it would mean that the apparatus would have to be constantly going in order to supply light when any consumer might at his option desire to avail himself of it during the day or night. It would be like working a gas works without holders for storage, with the same disastrous results, financially speaking—namely, increased capital and wear and tear of retorts, and now and then all darkness for a short time in the town, if a sudden draught took place on the mains, owing to a large establishment lighting up without notice. This feature in electric lighting has not as yet shown itself, it being now at the will of the manufacturer of the light when the lamps shall be lighted and put out; but let the consumer have that power left to him, which he will claim as his right if he has to pay the bill, and another difficulty is once more placed in the way of electric lighting for towns.

I am, of course, presuming that there is no difficulty in generating electricity, for it is mere mechanical power that is required. Nothing is used in its manufacture, and consequently there is no end to its source. This leads me to the electric lighting systems of the present day, which are nearly all alike in their working, as regards divided lights. The plan adopted is to put from half a dozen up to, say, 20 lights on one circuit—that is to say, one machine has 20 lights put on its wire from leaving the machine to coming back. The distance may be no object, so long as your wire has conducting power sufficient; but here again you are met with a difficulty, otherwise you would increase the number of lamps indefinitely; that is to say, the limit of the power of the machine is soon reached, and the more breaks or resistances you put on the circut, so each of the lights is less in proportion, for the law of the flow of electricity is inversely as the resistance. Thus, let us suppose the current is represented by 100; now add to the outside circut the resistance of one lamp equal to the internal resistance of the machine, which is about the best result of the Siemens machines, and you have doubled the resistence to the current; therefore the total current is reduced to 50, of which the outside circuit has 25 available; that is to say, double the resistence, and the current is halved; treble the resistence, and the current is one-third, and so on. Therefore you will see how quickly the lights are reduced in power, and how soon the maximum

is reached, so that you could not have small lights so economical as large ones. The same is the case with lamps burning by incandescence; you all know that it is only the resistance to the current flow that converts electricity into heat.

I really cannot see the cause for gas directors becoming alarmed lest they should be driven out of the field for lighting our houses, for I am afraid that electricity, with its delicate working parts and complicated automatic cut-off arrangements—all which are claimed to be simple in action, but which I am certain would soon get out of order if left to take care of themselves in any ordinary house—I am afraid, I say, that the cut-off arrangements now in operation would be apt occasionally, under ordinary usage, to cut off all the supply on the circuits instead of that to a single house. For public squares, large halls, and for lighting the main thoroughfares of large towns, where more light is wanted than is now thought necessary by most local authorities, there, I say, gas and electricity will come into competition. But I am of opinion that our main thoroughfares are well illuminated during business hours by the shop light, almost without the gas in the street lamps; so that to employ electricity on a large scale would be a waste of money, just as much as lamps of 200-candle power being placed every 60 yards or so apart. After business hours there is, comparatively speaking, not anybody out of doors, and gas lamps are ample for the purpose of giving light. The scope which electricity has is necessarily very limited, there not being so very many large spaces that will need to be lighted up so brightly as to justify recourse being had to it in preference to gas. There is a larger field open for it in the transmission of motive power, in which electricians may reap more remunerative employment for their labors if they will accomplish their grand idea of utilizing the tides and the Falls of Niagara, in supplanting the present method of supplying motive power for the great industries of the world.

Discussion.

Mr. Newbigging said that his previously expressed opinion regarding electricity as a source of lighting had not undergone any change. Lighting by means of electricity was simply an expensive luxury so far. It was not a new light, as some people imagined. The electric light was about as old as gas lighting; but whereas the one had been found thoroughly practicable, and had been made subservient to our daily wants—had, in short, become an absolute necessity—the other still remained in embryo, having scarcely advanced a step toward meeting our requirements in that respect. He spoke, of course, more particularly as to the application of the light, because, without question, the means for its production had been much improved of late years. There could be no doubt that most of the glowing reports of the past two years of its triumphat success, and its application to the general purposes of life, were concocted with an object, such object being to depreciate gas property. Unfortunately, these exaggerated reports were only too successful, and the concoctors, or many of them, had been enabled to pocket money as the result. The electric light agitation had been initiated and kept alive by dreamers and schemers. Gas engineers had no desire to minimize the singular beauty and even value, in some respects, of the electric light; they simply desired that a modicum of common sense should be brought to bear in comparing it with work-a-day gas light. He had had the pleasure of witnessing the first electric light display that took place at Blackpool in September last. The general effect was something magnificent, but one instinctively felt that it could scarcely last. He never saw the electric light but the lines of Wordworth occurred to his memory:

> "It was a phantom of delight
> When first it beamed upon my sight;
> A lovely apparation, sent
> To be a moment's ornament."

He believed, however, that their Blackpool neighbors, assisted by their shrèwd gas manager, had contrived to make the electric light not only ornamental but highly useful and remunerative. It was the only place he had heard of where it had been made to pay. These far-seeing town-councillors at Blackpool kept the homely gaslight for their own use on ordinary occasions, and on *fete* days they gulled—well, he would not exactly use that word, though it was well known that gulls were plentiful enough at the seaside, but certainly they drew no end of visitors—he could not remember how many tens of thousands—to their very delightful watering-place. It might be looked upon as a case of magnetic or electrical attraction, and from personal experience he knew they (the visitors) were galvanized in the prices they had to pay for board and lodging on the special occasion to which he referred. Referring to Mr. Chew's paper, he said that it was a valuable contribution to the subject of electric versus gas lighting, and he congratulated Mr. Chew on the able manner in which he had arranged his information and given his practical experience.

The Vice-President said when this subject was first brought under his notice by the Mayor and one or two of the Aldermen of Blackpool, he told them that the public had a bias against gas managers having anything to do with the electric light. The number of articles which had appeared in various newspapers and magazines in all parts of the country against manufacturers of gas had led the public to the conclusion that electric lighting could not receive justice at the hands of gas managers. This was what he told the Mayor and other gentlemen, but they were determined to go on with the thing, and "gull" the public by offering them one more attraction than the place afforded. It therefore became his duty to advise the Corporation to use the light which appeared to have given the best result up to that time. It was known to scientific men that electricity used in large quantities, as in lamps of 6000-candle power, was the best way. He and some members of the Town Council visited several places, and witnessed the various lights which were in use. They examined the Jablochkoff system, and amongst other places visited Birmingham and saw the large public gardens there lighted up by 60 lamps on the divided principle. They also visited the Thames Embankment and Siemens's manufactory at Charlton. They found that these latter were the people to go to if they wanted to have the best results. The particulars as to what they had done had been laid before the meeting in the paper, and these gentlemen who had seen the electric light must know that the idea of adapting it to thoroughfares was altogether out of the question. It would not be a light that would supersede gas on the score of cost, so far as he could ascertain; but although the figures given in the paper were arrived at as carefully as possible, they could not tell the exact cost until the apparatus had been working for some years.

Mr. Hunter (Salford) remarked that for the past two years some people had been frightened by the electric light, and it had often been described to them as "the light of the future." Its advocates had had on their side nearly the whole of the newspapers, who had written up the light. No doubt it was to some extent what people said it was. It was good under certain circumstances, but these circumstances were very prescribed. It was very costly—more costly than gas. If they took 100 yards of street, he did not suppose the cost of lighting with gas would be more than ¼d. per hour, and electricity could not, he thought, be cheaper than this. He should like to have heard from Mr. Chew what was the cost per hour of every light they had at Blackpool; but it was easy to perceive that it bore no comparison, under the most favorable circumstances, with gas, so far as the cost was concerned.

Mr. Frith (Runcorn) said a good deal of interest had been taken in the electric light at Liverpool. Living as he did a short distance from that town he had felt interested in this matter, and had frequently seen the light in operation. The people of Liverpool were the first to obtain an Act of Parliament enabling them to spend money on the electric light. It had been introduced into a large reading-room, where it was turned on every night at half-past six. He had seen it there, but the light was flickering and pulsating all the time he remained in the room, and they could imagine how pleasant it was to sit down and read by a light like that. Another place in Liverpool where it was exhibited was in one of the large tradesmen's shops, where there was one light in the roof and another over the doorway. It was an excellent advertising medium, and from the crowds of people who went in, it would seem that the advantages to some persons were very great. It had been remarked that the electric light was not dangerous, but he knew that on one occasion a piece of the red-hot carbon which had fallen off one of the lamps set fire to some hundreds of balloons which were hung inside the building, and had well-nigh produced a catastrophe.

Mr. Mitchell (Coatbridge) observed that the electric scare had not been confined to England. They had had a sharp attack of it in Scotland some months ago, when it was reported that Mr. Edison had discovered the method of subdividing the electric light. A practical experiment was being made with the light at St. Enoch's Railway Station, Glasgow, but it was not altogether a success, and everybody and everything about the place presented a ghastly, sickly appearance. The gas had to be kept lighted, but turned down very low, to be used when the electric light went out, as it frequently did. The use of the light had been discontinued now, and they had fallen back upon the old system of lighting as the more preferable. One result of the experiment was that a number of improved gas lamps were brought to Glasgow for the purpose of reasoning with the public, and convincing them that there was a future for gaslighting even yet. He did not see that the electric light offered any advantages over gas in the newest and most approved lamps, and he believed it could never be used with any advantage for street lighting.

The President wished to make some remarks before Mr. Chew replied, because he thought he could say something, which would be an addendum to the paper, with regard to another electric light which had not come in for any consideration either in the paper or in the discussion. In describing the lamp, Mr. Chew spoke of the difficulty of supplying lamps at some distance from the source of supply. This was a difficulty which had in a great measure been overcome by electricians, as had been shown in the extension of the circle on the Thames Embankment, and by other systems brought

out, notably by one to which he should allude by-and-by. One remark of Mr. Chew's to which he wished to call attention had reference to the resistance which he described. He gave them the axiom that the resistance was inversely as the distance. That was a point not admitted in the evidence given before the House of Commons Committee on the question of electric lighting. The electricians stated, in fact, that they did not know what the resistance was. Further, Mr. Chew, Sen., stated in his remarks that street lighting by electricity was an entire fallacy. He (the President) did not wish them to come too hastily to that conclusion because Blackpool was not successful, and the cost was enormous. He did not think the Blackpool authorities were fortunate in getting the best system of electric lighting; indeed, the best had not been brought out at that time. Since then there had come out a system of lighting by electricity, known as the "Brush" system, worked in this country by the Anglo-American Electric Light Company. This had been put in operation in a large combing-shed in Messrs. Crossley and Sons mills, at Halifax. There they turned off the gas, and had no fear that it would be required to supplement or take the place of the electric light. The light was very steady. Sometimes there was a slight flicker, owing to the point of the carbon falling off, but there was no rising, or falling, or jumping experienced in the light. He had been down on two occasions, and had spent some time looking at it. They had in this shed 16 lamps, all supplied by one machine and on one circuit. They said each lamp was capable of giving a light of 2,000 candles; but, of course, this was a matter of speculation, and it was difficult to say whether it did or not. All he could say with reference to the illumination was that it could not be obtained with gas, except, perhaps, at a very large cost indeed. One machine of 14-horse power supplied all the 16 lamps. It would work 18 lamps, and could be bought for about £400. With the exception of the machine there was very little required in this system. There was nothing like that formidable strength of cable shown in the Siemens system necessary; the machine was what is called a high-intensity machine, and the wires were of very moderate strength. The 16 lamps displaced about 200 gas jets, and he assumed that the lamps and the machine, together with the cost of fixing, would be something like £750. This was the calculation which he made in his own mind. The proprietors were not willing to give very much information about it at present, but he was allowed the full privilege of making any observation he pleased, and whatever questions he put to the workmen, that they could answer, were freely answered. With regard to the lamp itself, the arrangement was beautiful indeed. The carbons were adjusted in much the same manner as in the Siemens's lamp, with the exception that the frame was double, and the rod which held the carbon was fixed to a cross-bar above, the adjusting apparatus being situated above the cross-bar. The arrangement to allow the carbons to come down gradually was very effective. There was glycerine, or some similar substance, in the top, which formed a sort of cushion, and regulated the apparatus, giving it a certain distance to travel so that the carbon came down very gradually. The lamps were also effective in another way. If one of them went out the circuit was not broken, and there was no alteration in the light afforded by the other lamps. One might break the carbon in two and extinguish the light, but all the other lamps went on, and were not affected in the least, and one or more of them would go out in that way without disturbing the remainder. This he considered a very great step in advance. Now he would come to the cost. Taking the power at 14-horse, and the cost of the whole, as he assumed it, at about £750, interest and depreciation would amount to £75 per annum, and allowing for attendance £25, the total fixed cost per annum would amount to £100. There was in addition to this fixed cost the cost of the carbons, which they admitted to be at the rate of 1s. per hour for the 16 lamps. Then he assumed the cost of power at ¼d. per horse, or for the 14-horse power 3½d. per hour. This gave a cost of 1s. 3½d. per hour for lights to take the place of 200 gas-jets, consuming, say, 1000 feet of gas at a cost of 3s. In the case of ordinary working in winter time, the number of hours for a mill to burn artificial light was 306. This, with the electric light, cost £119, being at the rate of 1s. 3½d. per hour for ordinary expenditure, which amounted to £19, and, in addition, £100 for the fixed charges. The cost of gas, at 3s. per 1000 feet, for the same time would be £45. Now, this was really the most perfect system of electric lighting which had been introduced, and he thought it would be worth their while to consider it. There could be no doubt that in cases where particular work had to be performed, as in wool-combing, and where there were delicate colors to be manipulated, as in dyeing, this would become a most useful light; but, as would be seen, it would be more costly than gas. The advantages which it offered would, in fact, have to be purchased at a higher rate, the comparison between the electric light and gas being about 120 to 46. But as most of this was fixed cost, in cases where they could work overtime the fixed cost would be reduced, and the light might become cheaper than gas.

Mr. Chew, in reply, said that, in answer to Mr. Hunter's question, the cost of electric lighting at Blackpool was £3 6s. 10d. per night for each lamp of 6000-condle power. Referring to the Brush light, of which the President had spoken, he said it had been fully described in the *Electrician*. That journal some time ago contained a comparative table which showed that while the Brush light worked at an expenditure of 31 per cent. of electricity the Wallace-Farmer machine required only 14 per cent., and the Gramme machine 38 per cent. Unfortunately, the Siemens machine was not down in the table, and he could not carry the comparison so far as he should like, but he thought it was equal to the best known.

The President—No, no.

Mr. Chew said one point referred to was the extinguishing of the lights. They were not so much troubled with that as formerly, but it was due to the delicate apparatus being exposed to the weather and refusing to act. Financially, he thought gas lamps would be more economical than the electric light. Another point mentioned was that they could not distribute the current over long distances. He did not say it could not be done. They could take the lamps ten miles from the source of supply, providing they had wires sufficient to carry the electricity.

OFFICE-BEARERS FOR 1880–81.

The following are the Officers of the Institution for the current year :—

President.....Mr. William Carr.....Halifax.
Vice-President.....Mr. John Chew.....Blackpool.
Treasurer.....Mr. James Paterson.....Warrington.
Honorary Secretary.....Mr. Robert Hunter.....Stalybridge.

Members of Committee.

Mr. Samuel Barratt, Manchester.
Mr. Henry A. Coles, Todmorden.
Mr. J. G. Hawkins, Wigan.
Mr. Wm. Littlewood, Manchester.
Mr. G. E. Saville, Sowerby Bridge.
Mr. Harrison Veevers, Assoc. Mem. I.C.E., Dukinfield.

Ex-Officio Members of Committee.

Mr. David Clarke, President, 1878, Ashton-under-Lyne.
Mr. Thos. Newbigging, M.Inst.C.E., President, 1879, Manchester.

Auditors.—Mr. G. Smedley, Buxton; Mr. Edmund Lord, Whitworth.

Gas Matters in New Bedford.

SPECIAL MEETING OF THE BOARD OF ALDERMEN.

A special meeting of the Board of Aldermen was held this evening, (Tuesday, May 4th), Mayor Soule in the chair, for the purpose of giving a hearing to Israel C. Cornish and Henry G. Dennis, petitioners, on behalf of a gas company, for the leave to lay gas mains in certain streets. The full Board was present.

The Mayor read the petition, and then Mr. Cornish said before the hearing he would like to amend the petition by striking out the streets specified and also the time limit, giving the company the right to lay in any streets, with no limit as to time. He further said gentlemen of responsibility were ready, as soon as the right to open streets was granted, to go ahead and erect works for the purpose of supplying citizens with gas, and closed by saying he was prepared to furnish whatever information on the subject the Board might wish,

The Mayor said the Board would like to know what kind of gas the company would furnish.

On motion of Alderman Hammond it was voted that the petitioners be allowed to amend their petition as they wished.

As amended the petition was then received.

Mr. Cornish said the gas the company would furnish if the petition was granted was hydrogen gas, the same as used by the Municipal Company of New York, and also in Brooklyn, Baltimore and Poughkeepsie.

Thomas M. Stetson, Esq., appeared in behalf of the remonstrants to the petition, and thought if the petitioners propcsed to ask the privilege of digging up the streets to all eternity they should show what privilege was to accrue to New Bedford by granting them the privilege. The remonstrants regard the movement as a raid upon the vested capital of this city, and Mr. Stetson said if they would show their hands he would proceed to ask questions, but now he was in the dark, as they had made out no case.

Mr. Cornish said if it had been thought necessary plenty of signatures to the petition could have been secured.

Dr. James M. Ryder of New York then made a statement, and was questioned by Mr. Stetson. He said he always supposed when parties wished to obtain the privilege of laying either gas or water pipes it was customary to petition the authorities for such leave. The gas furnished by the Municipal Company is called water gas, and gives a clear white light of 30 candle power. The oldest company in New York, of which Moses Taylor is at the head, has recently changed its method of manufacturing gas and paid $300,000 for the privilege of using the method of manufacturing employed by the Municipal Company, as by it the gas can be made cheaper and better. There are three reasons why the hydrogen gas manufactured by the Municipal Company is an improvement over coal gas—first, it is clearer; second, it is

heavier and therefore consumers do not use so much; and third, it can be produced much cheaper.

Mr. Stetson here asked if the Municipal Company was corporately organized according to the laws of Massachusetts; and Dr. Ryder acknowledged that there was no organization here.

Mr. Stetson then said the petition could not be acted upon.

Dr. Ryder said this was a mere technicality, and that an organization could be secured in 48 hours. He then proceded with his statement, saying the process used is the Allen-Harris, and is in use in Poughkeepsie, and by it 100,000 feet of gas can be produced from one ton of anthracite coal by a continuous process. There is another gas company in Poughkeepsie, but since the introduction of the hydrogen gas the price has been lowered from $3 to $2 per thousand feet, and the new company furnishes two-thirds of all in use in the city.

Mr. Stetson here asked if Dr. Ryder could state the amount of gas manufactured in this city, and as he could not the statement was made to him that it was about 24,000,000 feet, which would require a capital of from $250,000 to $300,000.

Mr. Stetson said he supposed it was a mere bagatelle to Dr. Ryder.

The latter replied with some asperity that this would be a large sum to him, whatever it might appear to Mr. Stetson.

This closed the case for petitioners, and then George B. Neal, who has been connected with the Charlestown Gas Company since 1852, was questioned on behalf of the remonstrants, and said his company formerly manufactured 50,000,000 feet of gas annually, but the amount was now reduced considerably on account of the competition of petroleum. He had been in several competitions with gas companies, and had not found such movements to be beneficial to the consumers. He had not a high opinion of water gas, (which was not hydrogen, as Dr. Ryder had stated), and thought coal gas could be supplied cheaper. The expenses of laying pipes and distributing to consumers by a new company would be as great as by those already established, and would not create any more demand for consumption. The result of forming new companies was, according to his experience, that although temporarily the price of gas was reduced, consolidation of the companies resulted, when the price was enhanced so that the consumers were obliged to pay the interest on the extra capital employed. This had been the case all through the country so far as his observation had extended. Mr. Neal was surprised to hear Dr. Ryder say that no more than three or four per cent. of carbonic oxide existed in water gas, and said from analyses he had heard of it had been found to contain as high as 30.

Mr. Stetson here interpolated that the New Bedford Gas Company was ready as soon as a cheaper or better gas was invented to introduce it without waiting for outside parties to move in the matter, and then read from the law passed by the Legislature this year, showing that whenever upon three inspections gas manufactured shall be found to contain over 10 per cent. of carbonic oxide, the company shall be subject to a fine of $100.

Dr. Ryder here interfered, and Mr, Stetson said sharply, "You have not yet ridden over the people in this town."

To this Dr. Ryder replied, "No, nor I don't propose to; but I suppose you allow a man to come into town, provided he declares his intention of becoming a citizen."

Mr. Stetson—"Yes, if he is polite."

Dr. Ryder—"What constitutes politeness is a matter of personal opinion."

A. B. Slater, Secretary and Treasurer of the Providence Gas Company, which has a capital of $2,500,000, said he had been in the business since 1853. There has been a rival gas company in Providence. For 21 months the rival existed, and by sharp practice secured some 400 customers, finally taking contracts to supply gas for $1 a thousand feet. The old company some six months before the establishment of the new one reduced the price from $2.25 to $2 per 1000 feet, and then held at that price. The result of the competition was that the old company bought out the new, and the citizens of Providence now have to pay $2.20 per thousand feet, which would not have been the case had the new company been kept away. In the opinion of the speaker the effect of establishing rival companies was not beneficial to citizens generally. There is trouble from having two sets of pipes in the streets, and danger from leakage, because one company is apt to think the leak is in the pipes of the other, and hence delay in making repairs. Another trouble in putting double the amount of capital into gas companies which the needs of a city require is that consolidation must ensue, and the consumers have to pay the interest on the whole capital in increased rates. In water gas the amount of carbonic oxide cannot be under 20 per cent., and the weight of testimony is that it ranges from 20 to 40 per cent.

In answer to a question by Dr. Ryder, Mr. Slater said he thought the fact that the price of gas in Providence now is $2.20 per thousand feet against $2.25 before the establishment of the rival company is not due to the competition, but owing to improved methods having been discovered in manufacturing. The Providence Gas Company paid $500,000 to its rival.

Mr. Stetson here submitted the remonstrances of Leander A. Plummer and 300 others, of Jacob A. Howland and 60 others, and George O. Crocker and 75 others against granting the prayer of the petitioners. The remonstrances were received and placed on file.

Mr. Stetson then called on George Howland, Jr., for his opinion in regard to granting the petition, and that gentleman thought it would be bad policy and result in great inconvenience if the streets were to be cut up for the purpose of laying pipes, especially when the result was likely to be consolidation and an ultimate rise in price.

Gen. James D. Thompson failed to perceive any advantage which would accrue to the citizens of New Bedford by the establishment of a rival gas company, while infinite annoyance would result from digging up the streets for an indefinite period.

Robert B. Taber said he has been in the employ of the New Bedford Gas Light Company for the past four years. During that time the average annual earnings have been from 9½ to 10 per cent., but this does not make any allowance for insurance, or any other risks. There is danger from leakage of mains and the gas penetrates the sewers, sometimes causing an explosion, as was the case in Kempton street. The policy of the company has always been to carry gas mains into streets where there is any possible chance of remuneration. A main was extended 1700 feet from Howland Chapel to St. James Church, and there were but two services on the route. The company always intends to reduce the rates so that there will not be more than 9½ to 10 per cent. dividends. The worst competitor a gas company has is kerosene oil. Mr. Taber exhibited a table showing the net price of gas and its candle power in the different cities and towns using it in Massachusetts. The average price is $3.07 per thousand feet and candle power 16.28, while the price in New Bedford is $2.50, and the power 18.50. The price in New Bedford is 57 cents per thousand less than in the average of the cities of Massachusetts, while the illuminating power is 12 per cent. greater, and in only three cities is it sold at a less price, and in these the consumption is from 2 to 30 times as much. The increased sales in these latter cities materially reducing the cost and price per thousand.

Mr. Stetson said all the interest the stockholders of the New Bedford Gas Company received, after paying insurance and other risks, was about 6 per cent.

Capt. Joseph C. Delano thought it would ultimately be a great injury to the citizens of New Bedford to have rival gas companies here. Such a project was analogous to competing railroad lines between small places. He should decidedly oppose the project. There were formerly two gas companies in this place, and he was a member of the opposition, which was finally gobbled.

Warren Ladd thought it would be of no benefit to have a new gas company in New Bedford. The new one would either sell out before the pipes were laid, or else there would be low prices for a while and then consolidation and a rise.

William J. Rotch thought in cities where the population and territory were large enough to give support two companies it might be well enough to have them, but he did not believe such to be the case in New Bedford.

Mayor Soule inquired if the State Inspector a number of years ago had not reported the gas in New Bedford to be the poorest in the State.

Mr. Taber said the inspector had since acknowledged that a mistake had been made in regard to this statement.

Dr. Ryder then said he hoped a further examination of the matter might be made of the subject of water gas, as to its freedom from carbonic oxide.

Mr. Neal made a further statement that competition had not resulted in reducing the price of gas in Boston, but said the subject had been judiciously handled there, and the reduction was caused by the employment of improved methods of manufacture, etc.

Mr. Stetson then argued briefly in behalf of the remonstrants, citing the law of 1870 in regard to corporative bodies, and saying that until a solid corporation is formed with a paid in cash capital petitioners cannot be granted permission to dig up our streets. There must be something substantial for the city to fall back upon in case of lawsuits arising from accidents incurred from disarranged streets. The Board of Aldermen, as guardians of the public welfare and the city's interests, should be satisfied that a real and genuine company is back of this movement and that proper safeguards are exacted. Let the Board ask petitioners to give a bond in the sum of $50,000 never to consolidate their company and see how they will stand it. We have the testimony of our prominent, practical business men, and of experienced gas manufacturers, that establishing another gas company in our city would result in no permanent advantage either to our city or the consumers. In our own company are 132 citizens, not all wealthy men, who have placed their money underground, where it cannot be taken out and placed in a cotton mill, and they are worthy of some consideration. For the past four years our company has had but 9½ per cent. dividends, and has taken all the risks of manufacture, etc., including 2 per cent. insurance, so that only about 6 per cent. has been the gross receipts. Mr. Stet-

son said he would say nothing about the inconvenience to travel arising from digging up the streets, but prophesy if the petition was granted that in a few years consolidation would come and the people have to pay the interest on the increased capital invested.

Dr. Ryder said all the matters disputed in regard to the petitioners could be settled by examination. He would have an organization effected according to the laws of the State, with the capital all paid in and most of it owned in New Bedford, provided he could receive a guarantee that permission would be granted to lay pipes.

Mr. Cornish asked that the hearing be adjourned to a future time.

Mr. Stetson said he had supposed the hearing would be closed at the present time, and he should not be able to attend, as he was going out of the State to be absent some weeks. The Mayor thought in justice to all parties further time should be granted.

On motion of Alderman Sherman the matter was laid on the table, but subsequently it was referred to a special committee consisting of Aldermen Hammond and Cooke.

This closed the hearing, and the large company of spectators which had been present all the evening dispersed. The Board then proceeded to the transaction of other business.—New Bedford *Evening Standard.*

[From the London "Journal of Gas Lighting." March 2.]

Spence's Metallic Compound and its Use for Pipe Joints.

In reference to the paper read before the Society of Arts on the 11th ult., on "A New Metallic Compound and its Application to Industrial and Artistic Purposes," and the discussion thereon [see p. 154 this JOURNAL], Mr. Robert Morton, of the London Gas Light Company, writes to the Society to say that while the compound is very easily manipulated, it is also excessively brittle—a fact altogether ignored or overlooked in the paper and discussion. With regard to its use in jointing socket-pipes, Mr. Morton says that having had his expectations raised in this direction, he is reluctantly compelled, in the interests of his professional brethren and anyone contemplating its use, to state that, contrary to Mr. Livesey's experience, he has, as yet, been unable to get a sound joint by its use. At his works they have tried a considerable number of 4-inch pipes, about half of which were made under the immediate supervision of Mr. Spence's representative, and not one of them has stood the test, the major portion leaking under a pressure of from 3 inches to 5 inches of water.

Mr. W. Faija, of Westminster, also writes on the same subject. In the course of his letter he says: "That there are many uses to which the metal can be put there is no doubt, and it seems to have given satisfaction both to Mr. Livesey and to Dr. Cole in the work for which they have each used it; but I think they are in error in saying it expands in setting. It has a very limited range of temperature it which it is in a liquid state, and consequently, when poured into a mould, chills or cools quickly on the outside, and thus draws the still molten metal in the centre toward the sides. The result is that it is most difficult to obtain a sound casting of any thickness. The outside will be smooth and perfect, and will fill the mould well, and may thus lead to the supposition of its expansion. If the metal is thin, the casting will no doubt be generally sound, but if any thickness of metal is required, some special means of casting will have to be adopted, or there will, undoubtedly, be a cavity in the centre. Mr. Livesey seems to have got over the difficulty of its getting alight, which it does very easily while it is being melted; and if he has broken any of the pipe joints he has made, it would be interesting to know the result of his examination. I should not be disposed, with my present knowledge of the material, to endorse the opinion as to its elasticity. It has not the ductility of lead, and hence gives different results; but I should consider that the continuity of the pipes experimented with was maintained more by its hardness and unyielding properties than by its elasticity. I may say the experiments I made were to determine the tensile strength of the metal, which proved to be about 600 lbs. per square inch of section."

[From the London "Journal of Gas Lighting," April 6.]

SIR:—I am sorry that your correspondent, Mr. J. L. A. Hope, should think my letter on the subject of "Spence's Patent Metal," addressed to the Secretary of the Society of Arts, and referred to by you in your issue of the 2d of March, "calculated greatly to mislead * * * the engineers of the various gas companies of England." I wrote, as the letter itself says, in the interests of my professional brethren," the very gentlemen Mr. H. desires should not be misled. I know that from them at least I get credit for honesty of purpose in so doing. In my letter I unfortunately used the word "pipes" instead of "joints;" but doubtless all who read it, including Mr. H., knew very well what was meant. I would repeat that about half of the joints were "made under the immediate supervision of Mr. Spence's representative, and not one of them stood the test." They were made precisely as Mr. H. says those which he tried were made—two at least of the number under Mr. Spence's own eye.

It is only just, perhaps, to state that when Mr. Spence saw the result he said he thought there was something wrong with the "metal;" that he would take it (about 10 cwt.) away and replace it. That was on the 11th of February, on the evening of which day the "metal" was introduced to public notice at the meeting of the Society of Arts, and since which time I have not seen or heard from Mr. Spence. R. MORTON.

London Gas Light Company, Nine Elms, S.W., April 5, 1880.

SIR:—Mr. Morton's experiments having been called in question by your correspomdent, Mr. J. L. A. Hope, I feel constrained to relate my experience with regard to Spence's metallic compound.

On hearing of the success which had attended its trial elsewhere, I made preparations for jointing up about 150 yards of 24-in. main, which it so happened that I had to lay for a temporary purpose above ground. The work was begun under the immediate supervision of Messrs. Spence's representative, who on leaving expressed his entire satisfaction. Since its completion it has been tried under a gas pressure equal to 4½ inches head of water, with the result that every joint leaks—the loss as registered through a meter amounting to 48 feet per hour, or at the rate of 1152 cubic feet per day of 24 hours.

In addition to this, some shorter lengths of 4-inch and 12-inch pipes were jointed up, also under the superintendence of Messrs. Spence's representative, and with a similar result. Not a joint was found to be sound under a gas pressure equal to 6 inches head of water.

CHARLES HUNT.

Birmingham, April 2, 1880.

Balmain's Luminous Paint.

At a meeting of the Applied Chemistry and Physics Section of the Society of Arts, London, held on March 11th, 1880, Prof. C. W. Heaton, F.C.S., read a paper, on "Balmain's Luminous Paint." We abstract the following:

I have been invited to give, this evening, an account of one of those practical applications of science which have always had a peculiar interest for members of this Society. In doing so, I shall be compelled to allude briefly to some scientific truths, familiar to many among my audience, and particularly to those who attended Mr. Preece's recent interesting lectures.

Every one knows that a ray of white light consists of minute waves or ripples, analogous to those of water, and of various lengths. The mean length of these waves, measured from the crest of one to the crest of the next, may be taken as the fifty-thousandth of an inch. They all travel in straight lines, and all with the same velocity, a velocity which is called the velocity of light. In passing through a prism, these lines of waves are refracted, or bent at different angles, and when afterwards allowed to fall on a screen, they are reflected back to our eyes, and a portion of them, acting on our optic nerve, produce the sensation of color. These rays are, therefore, called the visible rays. Here on the screen you see the spectrum of the white electric light.

The eye is, however, a very imperfect optical instrument, and is only sensitive to waves between certain limits of length. The real spectrum on the screen is much larger than the visible one. There is a portion beyond the red, which is called the ultra-red portion. The waves of this portion are too long to affect the eye, but are active in producing chemical and other effects. These rays are called the ultra-violet, actinic, or chemical rays. * * *

Passing by, in this imperfect sketch, several important names, we come to the greatest name of all Edmond Becquerel, who for more than thirty years has enriched science by his discoveries. He invented an instrument called the phosphoroscope, by which he was able to detect the phosphorescent power in bodies which remain luminous for very short periods of time. He showed that the power was a very common one in natural, as well as in artificially-prepared substances, and that it was possessed by organic as well as inorganic compounds, and particularly by all fluorescent substances. He analyzed the light emitted in each case by the spectrum, and determined its duration within certain limits of accuracy. These limits are singularly wide, extending from less than the 5,000th part of a second, to hours or even days. Of all phosphorescent bodies, the sulphides of calcium, barium, and strontium, are the most remarkable in regard to the duration of their light; and Becquerel has studied the modes of preparing these compounds with the greatest care, and has revealed many strange, and even startling facts in regard to them.

They can be prepared by the action of carbon on the sulphates, by the action of sulphur on the oxides and carbonates, and by the action of alkaline sulphides, and even of antimony sulphide, on the last-named compounds. The phosphori prepared by these various processes, differ widely in regard to the color and duration of the light which they

emit; and it is even possible to obtain shades varying from orange-red and indigo-blue, from calcium only. But this is not all. The calcium-sulphide obtained from calcite, is different from that from arragonite, though these minerals have the same chemical composition; and the differences remain even after each mineral has been dissolved in acid, reprecipitated by sodium carbonate, and then ignited with sulphur. This affords a strange, and, for the present, inexplicable example of molecular persistency. Becquerel holds that fluorescence and phosphorescence are one and the same phenomenon, the apparent differences being due solely to the different periods during which the absorbed light is emitted. The point is one which merits attentive study.

We now come to the immediate subject of my paper. The late Mr. Balmain, formerly of University College, and an excellent chemist, had for years made a special study of phosphorescent substances. He enjoyed the friendship of the Becquerels, father and son, and aided possibly by them, he succeeded in producing a constant and very powerful phosphorescent substance. Here is same of the substance. You see how strong a light it emits after exposure to the magnesium light. It occurred to him to patent the use of this and other phosphorescent materials, mixed with water or oil, as paints capable of being applied in the ordinary way to any surface. This patent for luminous paint is now in the hands of Messrs. Ihlee and Horne, of Aldermanbury, and, thanks to those gentlemen, I am able to show you a great many specimens of articles thus painted, and so to enable you to judge for yourselves of its proposed applications. I have, in the first place, a number of sheets of cardboard so painted, some of them framed and glazed, which you see emit, after insolation, an amount of light which is really remarkable. With these sheets, we can try a few preliminary experiments, which will assist in illustrating the nature of the phenomena with which we are dealing. Let us, in the first place, test the sensitiveness of the paint. Exposing a sheet of painted card, previously kept in darkness, to Leyden jar sparks from an induction coil, you see that each spark impresses its image on the card and makes it luminous. It is easy in this way to write luminous words on an otherwise dark card. You know how very short a time each spark lasts, and can, therefore, judge of the short time required for the illumination. The same fact is more roughly shown by striking a lucifer match in front of a dark pane. The momentary flash of the tip is, you see, enough to produce a very visible effect on the paint. * * * *

For an explanation of this curious phenomenon, we must go back 105 years, to Wilson, who first observed it, though in a different manner. We must remember that red and yellow rays are also heat rays; and Wilson showed that heat would stimulate the light for a time, only to cause it more rapidly to disappear. On a faintly luminous pane I place a can of hot water. Removing it after a minute, we find that the light in that place is much brighter than before. Cold diminishes the light, which, however, returns when the original temperature is restored. This I can easily show, by applying a block of ice for a minute to the luminous surface. Thus we see the importance in all experiments on the duration of phosphorescent light, of paying close attention to temperature.

We may now inquire how far this luminous paint is suited for actual use, and what kind of applications can be found for it. We have seen that it is very sensitive to artificial light. To ordinary daylight it is at least equally sensitive, and I have seen it tried, with a success which seemed to me wonderful, in a thick yellow London fog. A very short exposure produces the maximum of illumination, though, of course, the amount of this illumination depend on the quantity and quality of the light. The duration of the light is likewise dependent, to some extent, on conditions. When the paint has been exposed to the intense light of the sun, or of burning magnesium, a good deal of the brilliancy disappears quickly, but after that the fading is very slow; and it may be said that a more or less useful light will remain through the length of an ordinary winter's night. In an extreme case, I was just able to see the dial of a watch by the light emitted from a card which had been in total darkness for twenty six hours. In this case the card had been exposed to daylight of moderate intensity for two hours.

The next point to be considered is the durability of the paint. The oil seems to protect it wonderfully, even from the acid air and rain of London. I have seen a wooden bowl, which was painted by Mr. Balmain more than a year ago, and has for several months been exposed to the open air in London, in very bad weather. It still preserves its power. Equally effectual is the oil as a protection from water. Here you see the painted model of a life-buoy immersed in water. Its luminosity is very evident. In several respects, therefore, namely, as regards intensity of light, lasting power, and durability under fair condition, these painted surfaces seem likely to be useful as carriers of light into dark places, and through dark hours.

Let us now turn to the suggested applications of the paint. They may be divided roughly into the ornamental and the useful, and I need only mention a few out of the many that occur to the mind. In the former class. we may include these painted india-rubber balls, which are very pretty, and suggest nocturnal lawn tennis. Statuary, grotto-work, and ornamental tiles, also give striking and beautiful effects. Here is a large bust of the Prince Consort which has been painted and illuminated. You see how fine an effect it produces. Clock faces, so prepared, show the time all night, and watch-boxes enable us to do as much for our watches. The ends of lucifer match boxes have been painted with the same material. Here are a number of them. There would obviously be no difficulty in finding one of these boxes in the dark.

To pass to more important applications, the roofs of railway carriages have already been treated experimentally with the paint, with results that appear satisfactory. The light would, of course, only be employed for daylight trains which run through tunnels. Then, again, it is proposed to paint the names of streets, the directions at post-offices, sign-posts, and advertisements in the same way. Here are some framed notices, "Lodgings," "To Let," and such like, which would easily be seen through, at any rate, a great portion of the night. Still more important is the use of this luminous paint in gunpowder magazines, spirit stores, and for purposes of exploration in coal mines during seasons of danger, besides many such uses that may be thought of.

But of all the proposed uses of the luminous paints, none seem to me so important, or so certain of practical success, as the marine applications. Several of these have already been realized in a satisfactory manner. For signal and mooring buoys, for example, its utility is obvious. It is of the utmost importance that the buoys employed for marking channels should be seen easily, the safe entrance to a harbor or river frequently depending upon the successful passage through a line of buoys. The entrances to Poole Harbor and to the mouths of the Thames and Medway are marked in this way, and great difficulty and danger are often experienced on dark nights in making out the buoys. Now, there can be no doubt that a buoy thickly painted with luminous paint would remain visible through the whole, or nearly the whole, of a night. A few evenings ago I assisted at the trial of a small mooring-buoy at Erith. It was not placed in the water till nine at night, having, of course, been for some hours before in darkness. We found that it was easily visible at distances of over a hundred yards, although the night was not a clear one, and the light to which the buoy had been exposed had not been very good. Yachtsmen, returning to moorings late at night, would find such buoys a great advantage, and many collisions might in this way be avoided. Equally important is the application of the paint to life-buoys. Life-buoys are, or should always be, kept on deck in convenient situations. A life-buoy thrown to a man overboard will often save his life, particularly if the man can swim. But what is the use of throwing out a common life-buoy on a dark night. It is impossible for a man to see it, and it is equally invisible to those on borrd. Here is a life-buoy painted with the luminous paint. Yet you see it emits a light that could easily be seen at a very considerable distance. Any decently good swimmer could reach it, while the ships' boats would know at once the point to which they must row.

Finally, there seems no doubt of the usefulness of the paint in diving and other submarine operations. We have ready a diver in full dress, painted all over with the luminous paint. He is being illuminated in the next room. Now he enters, and you see what a brilliant and ghost-like appearance he presents. At present one of the greatest difficulties in submarine operations arises from the intense darkness. With this new arrangement every diver will be his own lanthorn, and will carry down with him a stock of daylight that will assist his labors materially. This dress was actually so used at Southampton a day or two ago. Mr. Philip Hedger, the Superintendent of the Southampton Dock Company, has sent a letter to Messrs. Ihlee and Horne, in which he says that the diver descended, on a somewhat murky day, into 27 feet of not very clear water, and found that he was able to distinguish the bolt-heads and mussels on a ship's bottom with ease. Mr. Hedger seems to entertain no doubt of the success of the new application.

Let me, in conclusion, draw your attention to the splendid inscription, "Balmain's Luminous Paint," which stretches in letters of fire the whole length of the hall. It has been in darkness for two hours, and yet illustrates very simply the way in which the paint may be made useful for advertising purposes.

I may now conclude this brief and very imperfect sketch. I heartily wish the exposition had fallen into better hands, and particularly that our Chairman, whose well known researches on actinic light have added so much to our knowlege, would have taken the matter in hand himself. However, I have done my best, and can only hope that you have acquired some new ideas on the subject, and will in future watch with interest for further useful applications of the luminous paint.—*Journal of the Society of Arts.*

Dispensing with Sunday Labor.—At Manchester, England, owing to the excellent management and completeness of the Corporation gas works, Sunday labor has been dispensed with, a fact that cannot be too widely known, and will doubtless prove an incentive to the officials in other works to bring about so desirable a result.

THE AMERICAN GAS LIGHT JOURNAL AND CHEMICAL REPERTORY

A. M. CALLENDER & CO.,
PROPRIETORS.

Editor—G. WARREN DRESSER.

PUBLISHED ON THE 2ND AND 16TH OF EACH MONTH
At No. 42 Pine Street, New York.

This is a recognized official organ of—
LIGHT, HEAT, STEAM, WATER-SUPPLY,
VENTILATION, SANITARY IMPROVEMENT,
AND GENERAL SCIENCE.

TERMS

SUBCRIPTION—Three Dollars per annum, in advance.

AGENTS

NEW YORK—AMERICAN NEWS Co., 39 and 41 Chambers St
BOSTON—S. M. PETTENGILL & Co., 6 State Street.
PHILADELPHIA—PRATT & Co., Corner 9th and Arch Streets.
England—C. W. HASTINGS, 22 Buckingham St., London, W. C.
Germany—B. WESTERMANN & Co., of New York

MONDAY, MAY 17, 1880.

New Blasting Agent.

Experiments on an extensive scale have been recently made at the Saarbruck coal pits with an explosive called "blasting saltpetre" (*Spreng Salpetre*), and the results are stated to be favorable. The mixture is one of coal, sulphur, and soda-saltpetre, instead of the potash-saltpetre, or ordinary black powder. The constituent grains vary in size from 5 to 15 mm.; they are regular, with a rough surface of a grayish-black color.

The difference in price of blasting saltpetre and common powder is considerable; the average price of the latter at the Saarbruck pits is 62 pfennige per kilog., while that of the former is 52 pfennige. The chief disadvantage of the new material is its great sensitiveness to moist air, which may be counteracted by careful storage in dry places and introduction into tight metallic capsules, instead of leather bags. On the other hand it has, in the dry state, at least equal blasting force with black powder, its action is not so shattering, so that considerably larger detachments of coal can be effected with it. A principal advantage of the blasting saltpetre is its undangerous character. It is not exploded by mechanical shocks, and is therefore easily conveyed by rail. On being ignited in open space it burns quietly like a Bengal flame. The gases from its explosion are less troublesome to workmen. This blasting powder has also been used for some time past in the rock-salt mines of Stettin, and with the best success.—*Journal of Artificial Light.*

A Fire-Damp Meter.

Professor Forbes, of Glasgow, has announced the invention of an apparatus for accurately measuring the presence of fire-hamp in mines, and claims for it that its variation from accuracy was little more than one-half per cent. The experiments leading up to the invention had been made by him in conjunction with Mr. James Young, the discoverer of paraffin. The apparatus is said to be quite portable, and not liable to derangement, and by the aid of a philsophical dial can be introduced in places where even a safety-lamp cannot be used.—*Ironmonger.*

Carbonic Oxide.—Some idea of the mischievous effects of breathing carbonic oxide, which is freely given off by cast iron stoves, etc., may be formed from the experiments of M. Grehant. Respiration by man, or one of the lower animals, for about half an hour in an atmosphere containing only 1-779 of carbonic oxide produces such an action on the red corpuscles that just about one-half of them are capable of absorbing oxygen. Air having even 1-1449 of carbonic oxide had a like devitalizing result on one-fourth of the red corpuscles.—*Ex.*

Gas Stocks.

Quotations by G. W. Close Jr., Broker and Dealer in Gas Stocks.
(with W. B Scott & Co.,)

34 PINE STREET, NEW YORK CITY.

MAY 17, 1880.

☞ All communciations will receive particular attention

☞ The following quotations are based on the par value of $100 per share.

Gas Co.'s of N. Y. City.

	Capital.	*Par.*	*Bid.*	*Asked.*
Central	466,000	50	50	60
Harlem	1,800,000	50	72½	78
" Bonds	170,000			103
Manhattan	4,000,000	50	195	200
Metropolitan	2,500,000	100	138	—
" Scrip	$1,000,000	...	99	102
Mutual	5,000,000	100	78	82
" Bonds, gold	900,000	1000	100	—
Municipal	1,500,000	100	170	175
" Bonds	750,000		106	110
New York	4,000,000	100	100	102½
Northern	270,000	50	—	100

Gas Co's of Brooklyn.

Brooklyn	2,000,000	25	127	130
Citizens	1,200,000	20	72	75
" S. F. Bonds.	320,000	1000	100	105
Fulton Municipal	1,500,000	100	95	100
Peoples	1,000,000	10	30	35
" Bonds.	290,000	...	90	95
" Scrip	250,000	...	75	85
Metropolitan	1,000,000	100	60	70
Nassau	1,000,000	25	55	60
" Ctfs.	700,000	1000	85	95
Williamsburgh	1,000,000	50	68	73
" Scrip		...	98	103
Kings Co	135,000	100	60	70
" Bonds	40,000	—	—	—
Union Co. E. N. Y.		25	—	50
Richmond Co., S. I.	300,000	...	75	80

Out of Town Gas Companies.

Bath, Maine	70,000	100		
Buffalo Mutual, N.Y	750,000	100	65	70
" Bonds	200,000	1000	95	100
Baltimore, Md.	2,000,000	100	185	190
" Ctfs., gold	1,000,000		—	103
Bayonne, N. J.		100		90
Brockport, N. Y.	25,000	100	...	80
Citizens, Newark	918,000	50	85	90
" " Bds.	124,000	—	105	10
Chicago Gas Co., Ills			125	—
Cincinnati G. & C. Co.				190
Derby of Conn.	160,000	100	60	80
East Boston, Mass.		25	114	120
Elizabethtown, N. J.	300,000	20	—	130
Fort Wayne, Ind.		100	...	—
Hannibal, Mo.	100,000	100	95	100
Hartford, Conn.	700,000	25	120	125
Hempstead, L. I.	25,000	100	...	—
Halifax N. S.	400,000	40	148	150
Hamilton, Ontario	150.000	40	117½	
Jersey City	750,000	20	155	160
Jamaica, L. I.	25,000	100	...	—
Jacksonville, Ill.	120,000	50	100	...
Lewistown Maine	400,000	100	70	80
Laclede St Louis Mo.	1,200,000	100	93	96
Long branch		20	30	40
New Haven, Conn.		25	120	140
Peoples, Jersey City		...	50	60
" " Bds.				5
Peoples of Baltimore		25	100	102
" Bonds.			106	—
Plainfield, N. J.	80,000	100	—	105
Perth Amboy		25	—	95
Pittsfield, Mass.			120	130
Rochester, N. Y.		50	70	80
" Citizens		100	50	60
Rondout & Kingston			75	80
St. Louis Missouri	600 000	50	300	—
Stillwater, Minn.	50,000	50	—	26
Saugerties, N. Y.	15,000	100	95	100
San Francisco Gas-Co., S. Fr'isco Cal.			82	83
Toledo, Ohio			95	97
Troy, Citizens	600,000	100	—	—
Washington, D. C.	1,500,000	20	170	185
" Scrip	500,000	20	100	110
Woonsocket, R. I.	150,000	100	80	...
Wilmington, Del.		50	174	...
Yonkers		50	—	70

Advertisers Index.

GAS ENGINEERS.

	Page.
William Farmer, New York City	214
George W. Dresser, New York City	237

GAS WORKS APPARATUS AND CONSTRUCTION.

Herring & Floyd, New York City	235
T. F. Rowland, Greenpoint, L. I.	235
J. W. Starr & Son, Camden, N J.	235
Delly & Fowler, Philadelphia, Pa.	235
Kerr Murray, Fort Wayne, Ind.	235
George Stacey & Co., Cincinnati, Ohio	235
Bartlett, Robbins & Co., Baltimore, Md.	235
Morris, Tasker & Co., Limited, Phila., Pa.	207
P Munzinger, Phila., Pa	236
Brown & Owen, Phila, Pa.	235

GAS AND WATER PIPES.

McNeals & Archer, Burlington, N. J.	234
Gloucester Iron Works, Philadalphia, Pa.	234
Robt. Campbell & Co., New York City.	234
James Marshall & Co Pittsburgh, Pa.	234
R. D Wood & Co., Philadelphia, Pa.	234
S. Decatur Smith, Philadelphia, Pa.	234
Warren Foundry and Machine Co.	234
Pancoast & Tarr, 28 Platt Street, New York City	234
Mellert Foundry and Machine Co., Reading, Pa.	230

PIPE CUTTING MACHINES.

A. C. Wood, Syracuse, N. Y.	231

RETORTS AND FIRE BRICK.

J. H. Gautier & Co., Jersey City, N. J.	232
B. Kreischer & Sons, New York City	232
Adam Weber, New York City.	232
Laclede Fire Brick Works, St. Louis, Mo.	232
Brooklyn Retort and Fire Brick Works.	232
Borguer & O'Brien, Phila., Pa.	232
Gardner Brothers, Pittsburgh, Pa.	232
Henry Maurer, New York City.	232

DIETERICH'S REGENERATOR FURNACE.

Chas. F. Dieterich, Baltimore, Md.	238

GAS METERS.

Harris, Griffin & Co., Philadelphia, Pa.	238
American Meter Co., New York and Philadelphia, Pa.	239
The Goodwin Gas Stove and Meter Co., Philadelphia, Pa	239
Harris, Heime & Mellhenny, Philadelphia, Pa.	239

GAS STOVES.

The Goodwin Gas Stove and Meter Co., Phila., Pa.	216
Retort Gas Stove Co., Providence, R. I.	240

VALVES.

Ludlow Valve Manufacturing Co., Troy, N. Y.	233

EXHAUSTERS.

P. H. & F. M. Roots, Connersville, Ind.	233
Smith & Sayre Manufacturing Co., New York City.	233

GAS COALS.

Penn Gas Coal Co., Philadelphia, Pa.	237
Perkins & Co., New York City.	236 237
Cannelton Coal Co., " " " "	237
New York & Cleveland Gas Coal Co., Pittsburgh, Pa.	237
Newburgh Orrel Coal Co., Baltimore, Md.	237
Despard Coal Co., Baltimore, Md.	237
Tyrconnell Coal Co., Baltimore, Md.	237
Fort Pitt Gas Coals	237
West Fairmont and Marion Coal Co., N. Y. City.	237
Montauk Gas Coal, New York City.	236

GAS ENGINES.

Schleicher, Schumm & Co., Philadelphia, Pa.	231

BURNERS.

C. Gefrorer, Philadelphia, Pa.	230

PURIFYING MATERIAL.

Connelly & Co., Pittsburgh, Pa. 230

TAR BURNER, AND BLOWER FOR BURNING BREESE.

H. E. Parson, New York City..... 207

PROCESSES.

Strong Gas-Fuel and Light Co. 236
Gwynne Harris, New York City..... 234

GAS FIXTURES.

Mitchell, Vance & Co., New York City..... 233

CEMENT.

S. L. Merchant, New York City..... 233
F. O. Norton, New York City..... 233

BOOKS.

Economy of Gas as a Fuel..... 232
Scientific Books..... 236
Cathels, Gas Consumer's Manual..... 239
Fodell's Book-Keeping..... 239
Journal des Usines a Gaz..... 236
Review of Gas and Water Engineering..... 239
Gas Analyst's Manual..... 235

Mellert Foundry & Machine Co.,

Limited. Established 1848.

MANUFACTURERS OF

CAST IRON GAS & WATER PIPE,

With Special Castings, Flange Pipe, Water Gates, Fire Hydrants, Lamp Posts, etc.

The Improved Canada Turbine Water Wheel. Machinery and Castings of every description for Furnaces, Rolling Mills, Grist and Saw Mills, Mining Pumps, Hoists, etc. Columns, Brackets, Iron Railings, etc., etc.

ARNOLD MELLERT, Supt., READING, PA.

WANTED,

An Experienced

Coal Gas Engineer,

CAPABLE OF TAKING ENTIRE CHARGE OF WORKS.

Address, S. R. C., 115, N. Y. Herald Office.

WANTED,

FOR A LARGE MANUFACTORY,

A GAS ENGINEER,

Thoroughly understanding coal gas machinery, and a person of good address. Address,

501-2t LOCK BOX 12, PHILA., PA.

CONNELLY & CO.,

SOLE MANUFACTURERS OF

Iron Sponge Purifying Material

AND

CONNELLY'S JET EXHAUSTERS.

PITTTSBURGH, PA.

PROPOSALS.

THE PRESENT CONTRACT OF LIGHTING THE CITY OF GUAYAQUIL BEING ABOUT TO CONCLUDE IN MARCH, 1881, THE TOWN COUNCIL

SOLICITS OFFERS FOR

Lighting said City with Gas

OR ANY BETTER ARTICLE.

The contractor may calculate on 600 lights as a basis, more or less. The proposals must be addressed to MR. GREGORIO DE YCAZA, President of the Town Council of Guayaquil, Ecuador, and will be received not later than July 31st next.

GUAYAQUIL, March 29, 1880.

PEDRO J. NOBOA, Secretary.

For further particulars, apply to R. and C. DEGENER, 50 Wall Street, New York City. P. O. Box 4279. 501-4t

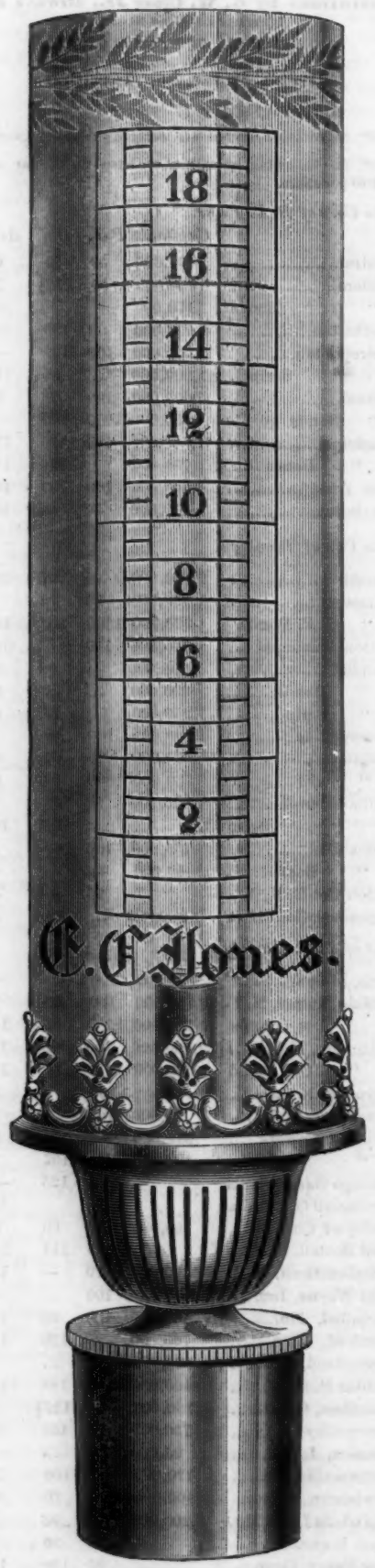
FOR SALE,

A SMALL AND PROFITABLE GAS WORKS,

In a thriving town of 3000 inhabitants. 2000 feet of Natural Gas per day. For particulars apply at office of this Journal, or o McNAB & MARS, 36 Cortland St., New York.

JONES' JET

Photometer.



Attention is called to this neat and very accurate Portable Jet Photometer, intended for use by Gas Companies. This instrument is adjusted to indicate the candle power of illuminating gas at any pressure varying from one to two and one-half inches, and may be applied to any burner nozzle. Its operation is continuous, the candle power as read from the scale being exact.

The Jones Jet Photometer is now being used by Gas Companies throughout the country, and its use is always attended with satisfactory results.

This Photometer will be found as correct as any of the more expensive Jet Photometers made. If not found as above, instruments may be returned. Full instructions in regard to adjusting, use, etc., will accompany each instrument.

Three kinds of Photometers are made:—

For ordinary coal gas,
For water gas carburetted,
For oil gas dilluted with air.

Parties ordering will indicate for which kind of gas the Photometer is intended to be used.

PRICE, $15 EACH.

Manufactured by E. C. JONES, and sold exclusively by the

National Petroleum Gas Co.,

Room 60, Coal and Iron Exchange, N. Y. City.

HYDRAULIC MAIN

For Sale, Cheap.

We offer for sale eight (8) sections of the Stanley Hydraulic Main, with two take-off ends, blank heads, tar valve, and dip-pipes complete. The Main is for setting of sixes, with seven-inch dip pipes.

CITIZENS' GAS LIGHT CO.,

501-2t ROCHESTER, NEW YORK.

Complete Gas Works

FOR SALE.

The Iron Work for a complete Gas Works, with 8 inch connections, consisting of 4 Purifiers, 8 ft. by 10 ft., with Dry Centre Valve, Multitubular Condenser, Scrubber, Bye-pass Valves, 5 feet Station Meter, and Bench Casting for four benches of 5's. All nearly new, and in good condition.

THE MUTUAL GAS LIGHT CO.,

497 tf ST. JOSEPH, MISSOURI.

C. GEFRORER.

Manufacturer of

GAS BURNERS,

GAS HEATING AND COOKING APPARATUS.

FITTERS' PROVING APPARATUS, ETC.

No. 248 North Eighth Street, Philadelphia.

ENGAGEMENT DESIRED.

A Person of Practical Experience as Superintendent of Gas Works

Desires an engagement where strict attention to the duties confided to him will secure ultimately a fair compensation. References can be given. A good, permanent position is desired, where future salary would depend on success of management. Address, "ENGAGEMENT,"

Office GAS LT. JOURNAL

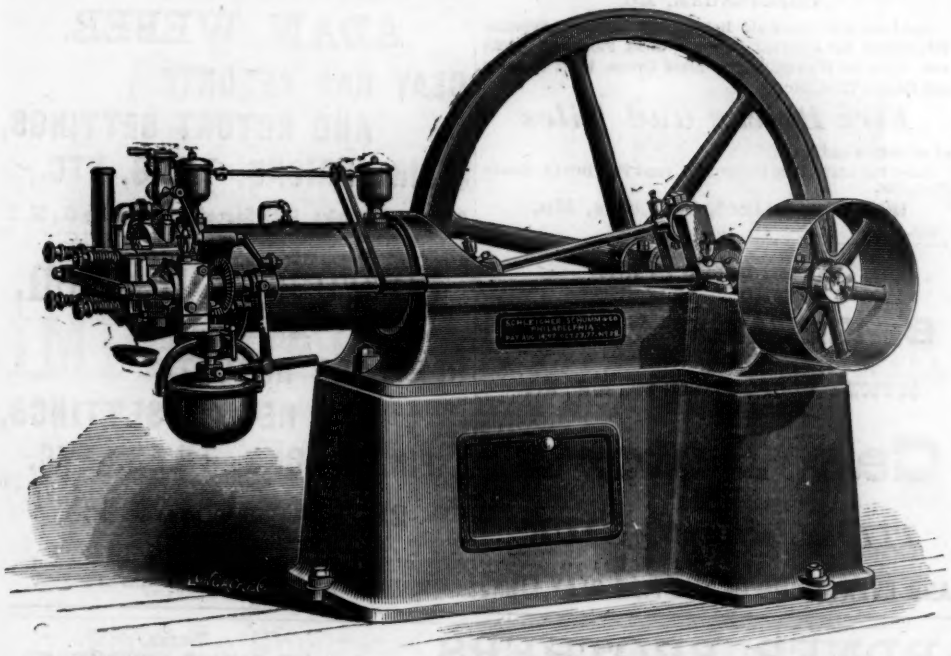
"How to Burn Gas."

Under this title a neat little book has been issued containing the paper of Mr. Jas. Somerville, as read at the last meeting at Cincinnati, together with a table, taken from Prof. Chandler's lecture, showing the loss of light resulting from the use of shades, etc., of different kinds of glass.

The price is $10 per thousand. Orders may be sent to the office of this Journal.

SILENT GAS ENGINE.

Always Ready to be Started, and to give at once Full Power.



NO STEAM TO MAKE OR MAINTAIN.

NO COAL, NO ASHES, NO

NO FIRE, NO DANGER, NO EXTRA INSURANCE

NO GAUGES, NO PUMPS NO LEAKAGE

ALMOST NO ATTENDANCE.

BURNS COMMON GAS.

AVERAGE CONSUMPTION PER HORSE POWER,

21 1-2 Cubic Ft. Per Hour.

COSTS NOTHING WHILE STANDING, LITTLE WHILE RUNNING WITHOUT DOING WORK, AND WHILE WORKING THE GAS IS PRECISELY REGULATED BY THE GOVERNOR IN PROPORTION TO THE POWER DEVELOPED

SIZES AT PRESENT OFFERED, **2, 4 and 7 H. P**

LARGER SIZES TO ORDER.

THE NEW OTTO SILENT GAS ENGINE.

Unexcelled for Convenience and Economy in running Gas Exhausters, Tar and Ammonia Pumps, Hoists in Warehouses or Stores, Ventilating Theatres, Halls and Buildings, Driving Electro-Magnetic Machines,

And useful generally for all work of small stationary steam engines. Where work is intermittent, trouble with a steam boiler and engine is at its maximum, but is at its minimum with a gas engine. For particulars, prices, etc., apply to

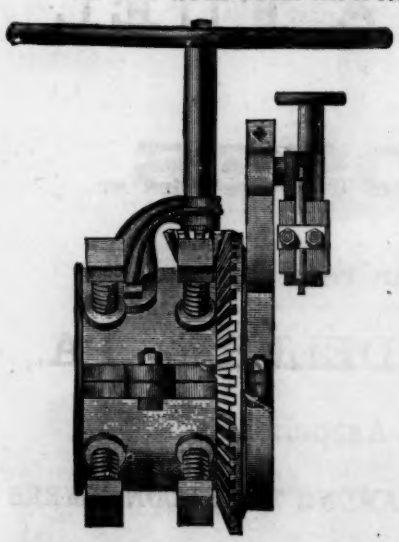
SCHLEICHER, SCHUMM & CO.,
3045 Chestnut Street, Philadelphia.

A. C. WOOD'S
CAST IRON PIPE CUTTER

PATENTED MAY 23rd, 1876.

PRICES REDUCED TO MEET THE TIMES.

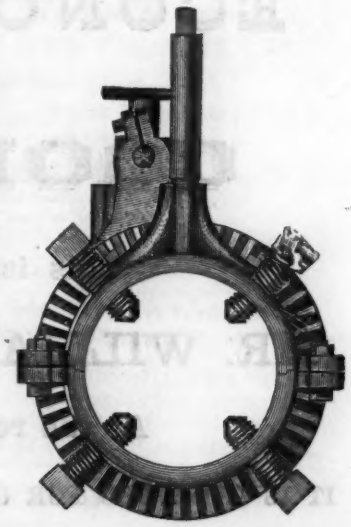
We have been able to reduce the cost of Manufacturing, and desire to give our Customers the benefit at the following



REDUCED RATES:

No. 1 cuts 3, 4 and 6 inch Pipe	*$75*
No. 1 1-2 cuts 4, 6 and 8 in. Pipe,	*$85*
No. 2 cuts 8, 10 and 12 in. Pipe,	*$100*
No. 3 cuts 16, 18 and 20 in. Pipe,	*$225*
NO. 4 cuts 24 and 30 inch Pipe,	*$275*
No. 5 cuts 36 inch Pipe,	*$350*

For larger sizes Special Contracts will be made.



It will cut a Continuous Line of Pipe in a Trench or Building

As well as loose Cast or Wrought Iron Pipe, Shafts or Columns of any size, leaving the ends clean, smooth, and square.

Our Machines for cutting 20 and 30-INCH PIPE have been furnished the Manhattan and New York Gas Light Companies; also for cutting 12, 20, and 30 inch Pipe to the Boston Gas-Light Company. The smaller sized Machines have been in practical use in various parts of the country by Water and Gas Companies, for over two years, and all with the most satisfactory results. Address

A. C. WOOD, Syracuse, New York.
HERRING & FLOYD, No. 744 Greenwich street, N. Y.
BROWN & OWEN, 20th and Filbert Sts., Philadelphia.
JOHN T. LANGFORD, 55 Kilby Street, Boston, Mass.

J. H. GAUTIER & CO.,
CORNER OF
GREENE AND ESSEX STREETS,
JERSEY CITY, N. J.
MANUFACTURERS OF
Clay Gas Retorts,
Gas House Tiles,
Fire Bricks, Etc. Etc.
Ground Clay, Fire Brick and Fire Sand in Barrels,
J. H. GAUTIER.
C. E. GREGORY
223-1y

BROOKLYN
Clay Retort & Fire Brick Works,
(EDWARD D. WHITE & CO.)
Manufacturers of Clay Retorts, Fire Brick, Gas House and other Tile.
VAN DYKE, ELIZABETH, RICHARDS & PARTITION STS.
Office, 88 Van Dyke St., Brooklyn, N. Y.

LACLEDE
FIRE BRICKS AND
GAS RETORT WORKS
CHELTENHAM, MO.
Hand and Machine made Retorts and Settings, Superior Fire Bricks for Siemans Gas and Glass Furnace. Bricks and Tiles for Whitwell's Hot Blast Ovens, Blast Furnace and Cupola Tiles, Etc.
Fire Bricks and Tiles
of all shapes and sizes.
Glass Pot Clay. Fine Ground Cla ynd Fire Bricks. Sewer Pipe, Etc.
901 Pine Street, St. Louis, Mo.
642—

ESTABLISHED IN 1845.
B. KREISCHER & SONS,
OFFICE FOOT OF HOUSTON ST., E.R., N.Y.
Cas Retorts,
TILES, FIRE BRICK.
AND EVERYTHING IN THE FIRE CLAY LINE.

MANHATTAN
FIRE BRICK & ENAMELLED CLAY
RETORT WORKS.
ADAM WEBER.
CLAY GAS RETORTS
AND RETORT SETTINGS,
FIRE BRICKS, TILES, ETC.,
Office and Works, 15th Street and Avenue C., N. Y.

Borgner & O'Brien,
MANUFACTURERS OF
CLAY GAS RETORTS
AND RETORT SETTINGS,
FIRE BRICKS, TILES, ETC.
23d St., Above Race,
PHILADELPHIA.
TWENTY YEARS' PRACTICAL EXPERIENCE.

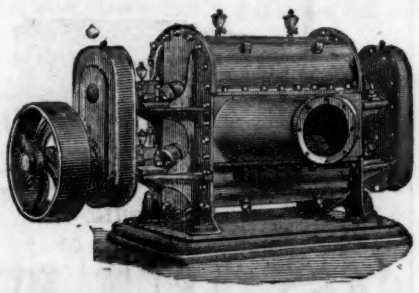
Works, LOCKPORT, PA.
GARDNER BROTHERS,
Works, MT. SAVAGE JUNCTION, MD.
—ESTABLISHED 1864.—
CLAY GAS RETORTS, RETORT SETTINGS, FIRE BRICK, TILES, Etc.
MINERS & SHIPPERS OF FIRE CLAY.
OFFICE, 116 SMITHFIELD ST., PITTSBURGH, PA.
C. H. SPRAGUE, No. 13 EXCHANGE PLACE, BOSTON, MASS., Agent for the New England States.

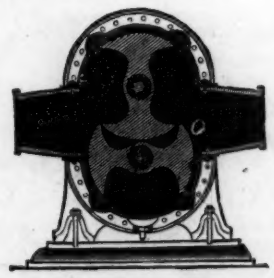
OFFICE, 418 to 422 East 23d St., New York. ESTABLISHED 1856. WORKS, PERTH AMBOY, NEW JERSEY.
HENRY MAURER,
Excelsior Fire Brick & Clay Retort Works
CLAY GAS RETORTS, BENCH SETTINGS, FIRE BRICK, TILES, ETC.

THE
ECONOMY OF GAS AS A FUEL
FOR
COOKING PURPOSES.

This is a small Pamphlet containing the Paper read by
MR. WILLIAM W. GOODWIN, OF PHILADELPHIA, PA.,
At the recent meeting of the American Gas Light Association.
IT IS INTENDED FOR GRATUITOUS DISTRIBUTION BY GAS COMPANIES AMONG THEIR CONSUMERS
Price, Twelve Dollars per Thousand.
ALL ORDERS TO BE SENT TO
A. M. CALLENDER & CO., No. 42 Pine Street, New York.

P. H. & F. M. Roots'





IMPROVED GAS EXHAUSTER

With Engine on same Bed Plate, or without.

BYE-PASSES, GAS VALVES, GOVERNORS, ELBOWS, PIPE-FITTINGS, &C., FURNISHED TO ORDER.

P. H. & F. M. ROOTS, Patentees and Manufacturers, **CONNERSVILLE, IND.**

S. S. TOWNSEND, General Agent, 6 Cortland St. and 8 Dey St., N. Y.
JAS. BEGGS & CO., Selling Agents, 8 Dey St., N. Y.
WM. COOKE, Selling Agent, 6 Cortland St., N. Y.

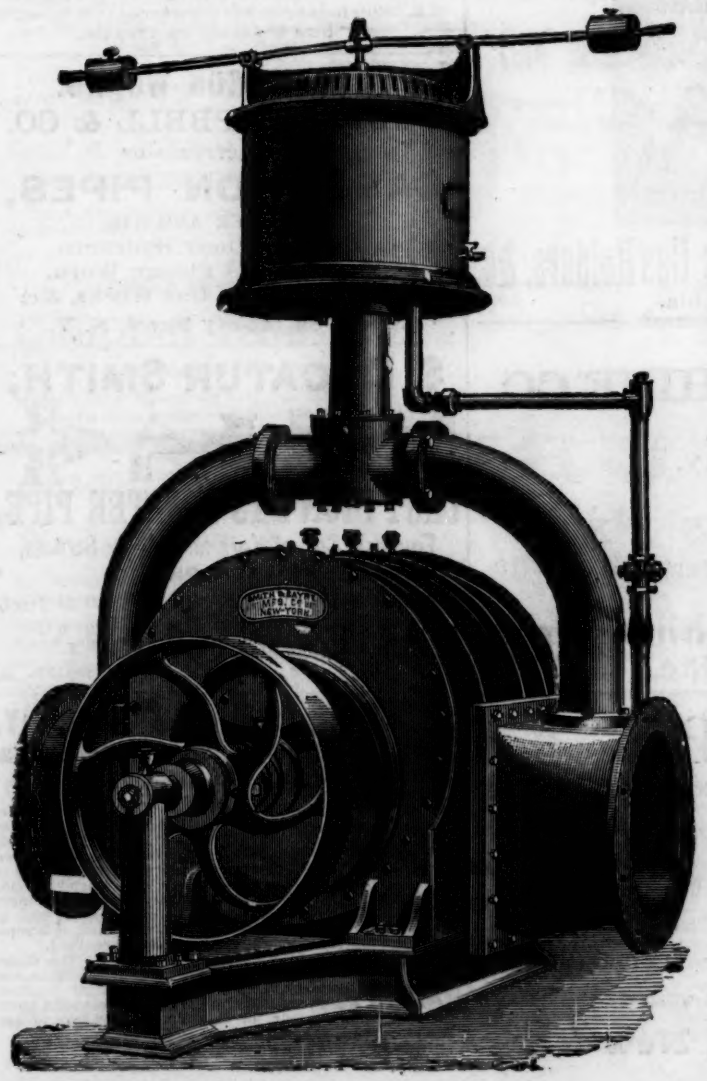
Send for Illustrated Catalogue and Price List.

SMITH & SAYRE MANUFACTURING COMPANY.

Coal and Iron Exchange, 21 Cortlandt Street, N. Y

BUILDERS OF

Machinery and Apparatus for Gas Works.



MACKENZIE'S PATENT ROTARY AND STEAM JET GAS EXHAUSTERS, GOVERNORS, COMPENSATORS, BY-PASSES, CONDENSERS, WASHERS, SCRUBBERS.

ISBELL'S PAT. AUTOMATIC STREET PRESSURE GOVERNOR.

HIGH SERVICE GOVERNOR, GAS AND WATER VALVES, HYDRAULIC MAIN DIP REGULATOR, BENCH CASTINGS, Etc. PURIFYING BOXES, TOWER SCRUBBERS, WITH AUTOMATIC WATER DISTRIBUTOR. *ISBELL'S PATENT SELF-SEALING RETORT DOORS.*

Plans and Estimates for the Improvement, Extension, or Alteration of Gas Works, or for the Construction of New Works.

G. G. PORTER, *President* CHARLES W. ISBELL, *Secretary.*

MITCHELL, VANCE & CO.

Manufacturers of

CHANDELIERS !

And Every Description of

GAS FIXTURES,

Also Manufacturers of

Fine Gilt Bronze and Marble Clocks, warranted best Time-keepers Mantle Ornaments, &c.

Salesroom, 836 BROADWAY.

NEW YORK.

Special designs furnished for Gas Fixtures for Churches Public Halls, Lodges, &c.

LUDLOW

Valve Manf'g Co.,

OFFICE AND WORKS

938 to 954 River Street and 67 to 83 Vail Ave.

TROY, NEW YORK.

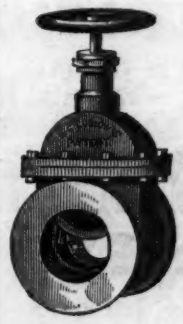
BRASS AND IRON SLIDE VALVES.

(Double and Single Gate ½ inch to 36 inch—outside and inside screw Indicator etc fo rGas .Wate rand Steam—

HYDRAULIC MAIN DIP REGULATORS.

ALSO

FIRE HYDRANTS.



REFERENCES FURNISHED.

SEND FOR CIRCULARS.

Portland Cement,
Roman Cement.
Keene's Cement,
Sellars Gas Cement.

English Fire Brick, No. 1.
" Silica Fire Brick.

IMPORTER

S. L. MERCHANT,

41 Broadway, New York,
Just below Trinity Church. 344-1y

☞ Remit 25 cents postage for "Practica Treatise on Cement.

F. O. NORTON,

MANUFACTURER OF

Hydraulic Cement,

Specially adapted for gas works. Under water it is capable of giving better results than Portland or any other cement.

90 BROADWAY (Cor. Wall St.,) NEW YORK.

Preserve the Journal!

We will furnish to our subscribers an important article for *preserving in a convenient form*, the numbers of the Journal as it is issued at the very low price of $1.25. Sent either by Express or Mail, as directed.

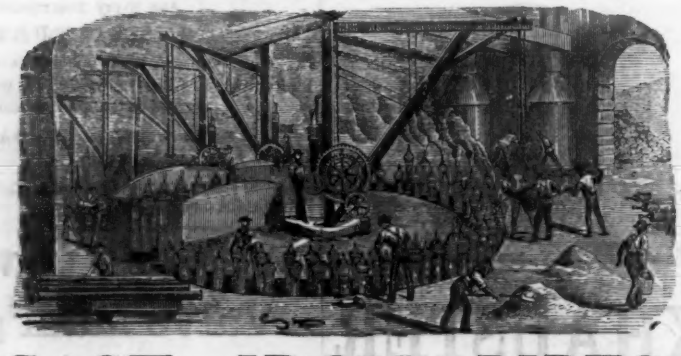
By mail the postage will be 20 cents, which will be added to the price of the Binder. Send orders to

A. M. CALLENDER & CO,
42 Pine Street, Room 18, New York.

M'NEALS & ARCHER,

BURLINGTON. N. J,

Flange-Pipes



General Foundry Work.

CAST IRON PIPES

FOR WATER AND GAS.

DAVID S. BROWN, Pres.
BENJAMIN CHEW, Treas.

JAS. P. MICHAELSON, Sec.
WM. SEXTON, Supt.

GLOUCESTER IRON WORKS,

GLOUCESTER CITY, N. J.

Cast Iron Gas & Water Pipes, Stop Valves, Fire Hydrants, Gas Holders. &c.

Office No. 6 North Seventh Street, Philadelphia.

ESTABLISHED 1856.

WARREN FOUNDRY AND MACHINE CO.,

WORKS AT PHILLIPSBURGH, N, J.
NEW YORK OFFICE, 153 BROADWAY.

Cast Iron Water and Gas Pipe

FROM TWO TO FORTY-EIGHT INCHES DIAMETER.
ALSO ALL SIZES OF

FLANGE PIPE for Sugar House and Mine Work.

Branches, Bends, Retorts, Etc., Etc. 456-1

CAST IRON PIPE.

WE HAVE ON HAND, IN STORE, FOR IMMEDIATE SHIPMENT,

A Large Quantity of Cast Iron Pipe,

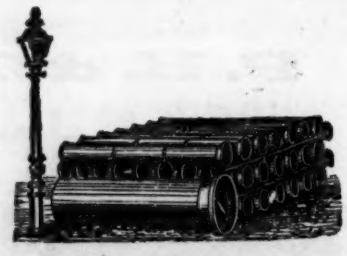
WITH A FULL ASSORTMENT OF SPECIAL CASTINGS.

MOST OF THEM ARE GAS WEIGHTS—PART OF THEM COATED WATER WEIGHTS.

Made by Warren Foundry, Wood, McNeals, and Camden Iron Works,

UNDER CAREFUL INSPECTION, AND ARE OF THE VERY BEST QUALITY.

PANCOAST & TARR, 28 Platt St., New York.



R. D. WOOD & CO.,

PHILADELPHIA.
MANUFACTURERS OF

CAST IRON PIPE

FOR GAS AND WATER
Lamp Posts, Valves, Etc.
Mathew's Pat. Anti-Freezing Hydrants,
400 Chestnut Street.

JAMES MARSHALL & CO.

Franklin Foundry and Pipe Works,

MANUFACTURERS OF

GAS, WATER, AND OIL PIPES

Works, 18th, 19th, 20th and Railroad Street.
Office, No. 23 Nineteenth Street.
Pittsburgh, Pa.

N.B.—Pipes from 3-inch and upwards cast in 12 ft. lengths.
☞ Send for Circular and Price List.

BERGEN IRON WORKS.

ROBT. CAMPBELL & CO.

MANUFACTURERS OF

CAST IRON PIPES,

FOR WATER AND GAS,
Valves, Fire and Dock Hydrants,
Lamp-Posts and Flange Work,
Bench Castings for Gas Works, &c.
Office, 85 Liberty Street, N. Y.

S. DECATUR SMITH,

CAST IRON GAS AND WATER PIPE,

Foundry, Cor. of York and Moyer Streets,
PHILADELPHIA.

Several Thousand 2, 3, 4, 6 and 8 Inch Cast Iron *Gas and Water Pipes* on hand, for immediate delivery.

☞ FITTINGS FOR GAS AND WATER MAINS.

NATIONAL COAL GAS COMPANY.

320 Broadway, N. Y., Rooms 50, 51 & 52.

H. P. ALLEN, President.

The process known as GWYNNE-HARRIS, but from later most essential improvements, more appropriately called the ALLEN-HARRIS, or AMERICAN HYDROCARBON process for making "Water Gas," by the decomposition of superheated steam, in fire-clay retorts, set similarly to those in Coal Gas Works, is an established success. More than One Hundred Million cubic feet of gas have been made under this process, and for *permanency* and *brilliancy*, as well as economy both to the manufacturer and consumer, it is superior to any gas made by the old, or any other method.

Our process is *not intermittent* but continuous. The steam and the oil are admitted into the retorts by gauge cocks, and run for days without change. All the materials required, besides the steam, are 17 lbs. of Anthracite coal and about 3½ gallons of Petroleum or Naphtha, per 1000 feet of brilliant gas.

Rights for sale. Inquire of the President.

Kerr Murray,

PRACTICAL GAS ENGINEER,

AND MANUFACTURER OF

ALL THE LATEST IMPROVED

Gas Apparatus,

MACHINERY,

ETC., ETC.

—WORKS,—

South of Railroad Depot,

FORT WAYNE, IND.

BARTLETT, ROBBINS & CO.,

ARCHITECTURAL IRON WORKS.

MANUFACTURERS OF

GAS HOLDERS, BENCH CASTINGS, MULTITUBULAR WATER AND AIR CONDENSERS, COMMON AND TOWER SCRUBBERS, ROTARY & STEAM JET EXHAUSTERS, WROUGHT IRON ROOF FRAMES.

MANUFACTURERS OF ALL DESCRIPTIONS OF GAS APPARATUS.

WORKS:

Cors. Pratt, Scott, McHenry, Ramsay and Bartlett Streets.

BALTIMORE, MARYLAND.

Plans, Specifications, and Estimates furnished. Correspondence solicited. 467-1y

---

JESSE W STARR & SON,

Camden Iron Works

Camden, New Jersey,

Office in Philadelphia No. 435 Chestnut St., where a member of the Firm can be seen between 12 m. and 2 p. m. daily.

MANUFACTURERS OF

ALL KINDS OF CASTINGS AND APPARATUS FOR GAS WORKS,

Wrought Iron Roof Frames.

For Retort and other houses. Retorts and all castings required for setting them in the latest and most improved model. WASHERS, CONDENSERS, SCRUBBERS and EXHAUSTERS for relieving the Retorts from pressure. PURIFIERS, varying from 2,000 to 2,000,000 cubic feet daily purifying capacity.

Wrought Iron Lime Sieves

or Purifiers. Station Meters of all sizes.

GAS HOLDERS.

TELESCOPIC AND SINGLE

With cast iron guide and suspension frame GAS GOVERNORS or REGULATORS, STREET MAINS, from 1¼ to 48 INCHES DIAMETER, for WATER or GAS. Street Main connections, such as BRANCHES, BENDS, DRIPS, SLEEVES, etc.

STOP VALVES, from 3 to 30 inches, for both Water and Gas.

Wrought Iron Work.

All the Smith and Sheet Iron work required in and about Gas Works. 296-tf

JESSE W. STARR. JESSE W. STARR, JR.

1842. DEILY & FOWLER 1880.

LAUREL IRON WORKS.

ADDRESS, 39 LAUREL STREET,

PHILADELPHIA.

MANUFACTURERS OF

GAS HOLDERS,

SINGLE AND TELESCOPIC—WITH CAST OR WROUGHT IRON GUIDE FRAMES.

We are prepared to furnish Holders, Wrought Iron Roof Frames, Bench Castings, Condensers, Scrubbers. Purifiers, Drips, Bends, Tees, and all other Iron Work connected with Gas Works. We have built 12 gas works and 122 gasholders. Personal supervision given to the erection of all our work. Holders built at following places since 1868:

Lancaster, Pa. (2)	Indianapolis, Ind.
Williamsport, Pa. (3)	Jacksonville, Ill.
Bristol, Pa. (2)	Joliet, Ill.
Catasaqua, Pa.	Lawrence, Kansas.
Kittanning, Pa.	Jefferson City, N. O. La. (2)
Hazelton, Pa.	Algiers, N. O., La.
Freeport, Pa.	Kalamazoo, Mich
Huntingdon, Pa.	Buffalo, N. Y. (2)
Pittston Pa.	Ogdensburg, N. Y.
Bethlehem (S). Pa.	Waverly, N. Y.
Sharon, Pa.	Little Falls, N. Y.
Canton, Pa.	Penn Yann, N. Y.
Carlisle, Pa.	Watkins, N. Y.
Beaver Falls, Pa.	Coney Island, N. Y.
Annapolis, Md. (2)	Batavia, N. Y.
Parkersburg, W. Va.	Gloucester, N. J.
Lynchburg, Va.	Salem, N. J.
Stanton, Va.	Mount Holly, N. J.
Youngstown, O	Plainfield, N. J.
Steubenville, O.	Englewood, N. J.
Zanesville, O.	Flemington, N. J. (2)
Mansfield, O.	Dover, Del.
Marion, O.	Pittsfield, Mass.
Bellefaire, O.	Meriden, Conn.
Athens. O.	Milwaukee, Wis.
Barnesville, O.	Burlington, Vt.
Newark, O.	Hoosick Falls, N. Y.
Columbus, O.	Attica, N. Y.
Franklin, Ind.	

BROWN & OWEN,

MANUFACTURERS OF

EVERY DESCRIPTION OF

Gas and Water Works Supplies.

Particular attention given to the alteration of old works. Estimates and Drawings furnished.

THOS. R. BROWN, **R. PITT OWEN.**

Late Chief-Eng. Phila. Gas Works.

Address all communications to

N. W. Cor. 12th and Noble Streets,

482-1y **PHILADELPHIA.**

HERRING & FLOYD,

Oregon Iron Foundry

738, 740, 742 and 744 Greenwich St., N. Y

MANUFACTURERS OF

ALL KINDS OF CASTINGS

AND

APPARATUS FOR GAS-WORKS.

BENCH CASTINGS

from benches of one to six Retorts each.

WASHERS: MULTITUBLAR AND AIR CONDENSERS CONDENSERS; SCRUBBERS,

(wet and dry), and

EXHAUSTERS

for relieving Retorts from pressure.

BENDS and BRANCHES

of all sizes and description.

FLOYD'S PATENT

MALLEABLE RETORT LID.

BUTLER'S

COKE SCREENING SHOVELS.

SABBATON'S PATENT

FURNACE DOOR AND FRAME.

SELLER'S CEMENT

for stopping leaks in Retorts.

GAS GOVERNORS,

and everything connected with well regulated Gas Works low price, and in complete order.

N. B.—**STOP VALVES** from three to thirty inches—at very low prices.

SILAS C. HERRING. JAMES R. FLOYD

GEO. STACEY. HENRY RANSHAW. WM. STACEY

GEO. STACEY & CO.

MANUFACTURERS OF SINGLE AND TELESCOPIC

GAS-HOLDERS

AND ALL KINDS OF

Cast and Wrought Iron Work

Used in the Erection of Gas and Coal Oil Works.

Foundry on MILL STREET; Nos. 33, 35, 37 and 39

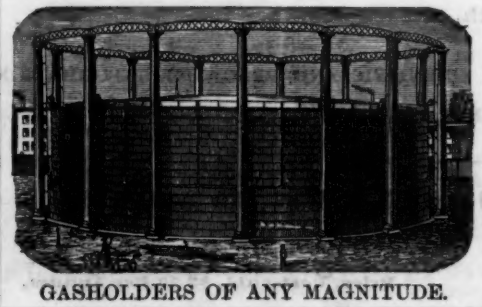
Office and Wrought Iron Works on RAMSAY STREET Cincinnati, Ohio.

REFERENCE.

Cincinnati Gas-Light Co.	Baton Rouge, La., Gas Co.
Indianopolis Gas Co.	Saginaw, Mich., Gas Co.
Dayton, O., Gaslight Co.	Oshkosh, Wis., Gas Co.
Covington, Ky., Gas Co.	Peoria, Ill., Gas Co.
Springfield, O., Gas Co.	Quincy, Ill., Gas Co.
Terre Haute, Ind., Gas Co.	Champaign, Ills., Gas Co.
Madison, Ind., Gas Co.	Carlinville, Ill., Gas Co.
Kansas City, Mo., Gas Co.	Bowling Green, Ky., Gas Co.
Topeka, Kansas, Gas Co.	Hamilton, Ohio, Gas Co.
Burlington, Iowa, Gas Co.	Vicksburg, Miss., Gas Co
Nashville, Tenn., Gas Co.	Denver City, Col., Gas Co.

R. T. Coverdale, Eng'r Cincinnati, and others.

CONTINENTAL WORKS.



GASHOLDERS OF ANY MAGNITUDE.

T. F. ROWLAND, Proprietor,

GREENPOINT, BROOKLYN, N. Y

ENGINEER AND MANUFACTURER OF

GAS-HOLDERS,

CONDENSERS, SCRUBBERS, VALVES, PURIFIERS, RETORTS, and HYDRAULIC MAINS,

and all other articles connected with the Manufacture and Distribution of Gas. Plans and Specifications prepared and Proposals given for the necessary Plans for Lighting Cities, Towns, Mansions, and Manufactories.

THE GAS ANALYST'S MANUAL.

BY F. W. HARTLEY, A.I.C.E., M.S.E. **E. & F. N. SPON, PUBLISHERS.**

PRICE, $2.50.

CONTENTS. SECTION I.—The purposes of photometry. Standard light. Standard burner. Gas Works Clauses Act Amendment Act, 1871:—Regulations in respect of testing apparatus, mode of testing for illuminating power, and for sulphuretted hydrogen. Description of standard apparatus. The photometer room. Preparation of candles. Testing operations. Readings. Correction for gas consumpt. Corrections for candles' consumpt. Corrections for barometric pressure and temperature. Ordinary photometers. The inferential or jet photometers. To set the jet photometer at work. To rate the jet photometer.

SECTION II.—Duration and mode of testing in London, sulphuretted hydrogen, ammonia, sulphur compounds. Preparation of solutions. Fitting up. To set the apparatus at work. Analysis.

SECTION III.—Ammonia. Sulphuretted hydrogen. Carbonic acid. The Cooper's Tube, or Eudiometer. To calculate weight of sulphur. Harcourt's color test. A rapid and accurate methodof estimating sulphur in coal gas. Specific gravity. To find the specific gravity of dry gas. To correct the bulk and find the weight of gas.

APPENDIX.—Rules and tables to facilitate the calculations necessary in the determination of the illuminating valu and degree of purity of coal gas. Photometry. Ammonia and sulphur. Proving of testing meters in London. The referees' cubic-foot measure. Times and mode of testing for pressure in London. Proposed standards of light.

A. M. Callender & Co., 42 Pine Street, N. Y.

NEWCASTLE AND PROVINCIAL GAS COALS.

THE UNDERSIGNED ARE PREPARED TO EXECUTE ORDERS FOR

NEWCASTLE COAL (TOWNLEY),

ALSO FOR THE BEST QUALITIES OF

PROVINCIAL GAS COAL,

DELIVERED AT ANY PORT IN THE UNITED STATES.

We supplied nearly 100,000 tons of Provincial Coal to some twenty-five different Gas Companies in 1877. These coals will yield in practical use fully

10,000 Cubic Feet of 16 1-2 Candle Gas---40 Bushels Coke.

JAMES D. PERKINS.
F. SEAVERNS.

PERKINS & CO. 41 SOUTH STREET, NEW YORK.

THE MONTAUK GAS COAL COMPANY

JOHN WHITE, President,

Trinity Building, No. 111 Broadway, New York.

WHARVES, LOCUST POINT, BALTIMORE, MD.

JAMES BOYCE, Agent and Shipper, BALTIMORE.

SCIENTIFIC BOOKS.

We are prepared to furnish to GAS MANAGERS and others interested in the topics treated of, the following Books, at prices named:

GAS MANUFACTURE, by WILLIAM RICHARDS, 4 to, with numerous Engravings and Plates, in Cloth binding. $12.

THE GAS ANALYST'S MANUAL, by F. W. HARTLEY. $2.50.

The above will be forwarded by Express, upon receipt of price.

We will take especial pains in securing and forwarding any other Works that may be desired, upon receipt of order. All remittances must be made by Check, Draft, or Post Office Money Order.

A. M. CALLENDER & CO.,
Room 18, No. 45, Pine Street, N. Y.

P. MUNZINGER,

Engineer and Contractor,

No. 1211 MARKET STREET, PHILADELPHIA, PENN.

BUILDER AND CONSTRUCTOR OF ALL KINDS OF GAS MACHINERY,

ON THE LATEST AND MOST IMPROVED PLAN.

Bench Castings, Condensers, Scrubbers, Purifiers, Centre Valves, Gasholders, Stop Valves, Etc., Etc.

Estimates and Drawings Furnished upon Application.

JOURNAL des USINES a GAZ.

Issued on the 5th of each Month.

THIS JOURNAL CONTAINS ALL THE LATEST SCIENTIFIC AND PRACTICAL INFORMATION RELATING TO GAS MANUFACTURE IN FRANCE.

MESSRS. SERVIER, MONNIER, AND ROUGET, EDITORS AND MANAGERS.

Subscriptions Received at this Office. Price, Post-paid, $3.50 Per Annum.

WATER GAS.

Strong Gas-Fuel and Light Co.,

No. 120 Broadway,

(EQUITABLE BUILDING), NEW YORK.

This Company is the Sole Proprietor for the State of New York of the Strong and Lowe Processes for the Manufacture of Water Gas.

Works are now being constructed according to the Strong patents at Yonkers, to supply that city with gas for

Light, Heat, and Power.

One pair of generators, the cost of which will not exceed $18,000, will make about 400,000 cubic feet per day.

The Lowe system is already in successful operation for lighting in more than thirty places in the United States, and in many of our large cities.

The rapid progress that water gas is making in the public favor, and the great economy and efficiency of the Strong and Lowe processes over all others for its manufacture, should secure for these processes a careful examination on the part of all gas companies now existing or about to be formed.

N. B.—For licenses or further information, appply at the office of this company, as above.

Dated March 8, 1880.

KING'S TREATISE

ON

COAL GAS.

Vol. I., Bound in Cloth, $10.

A. M. CALLENDER & CO., 42 Pine Street, N. Y.

THE ECONOMY

OF

GAS AS A FUEL

FOR

Cooking Purposes.

Price, $12 a Thousand.

THE AMERICAN GAS-LIGHT JOURNAL.

$3 PER ANNUM.

42 Pine Street, N. Y.

NEW YORK AND CLEVELAND

GAS COAL COM'Y

Of Pittsburgh, Pa.

MINERS AND SHIPPERS OF

YOUGHIOGHENY GAS COAL.

This Company is prepared to furnish any amount of their justly celebrated, and acknowledged superior GAS COAL, to any point reached by railroad or navigation. on most favorable terms.

General Office—89 Wood Street,
PITTSBURGH, PA.

Branch Office—120 Water Street,
CLEVELAND, OHIO.

WILLIAM A. McINTOSH, President.
A. CARNEGIE, Vice-President.
W. P. DE ARMIT, Treasurer.
THOMAS AXWORTHY. Agent at Cleveland, Ohio.

351-1y

THE NEWBURGH

Orrel Coal Company,

Mines at Newburg, Preston County, W. Va.
Company's Office, No. 52 S. Gay Street, Baltimore, Md.
C. OLIVER O'DONNELL, Pres't. CHAS. MACKALL, Sec'y.
CHAS. W. HAYS, Agent in New York, Room 7, Trinity Building, 111 Broadway.

This Company offer their very superior Gas Coal at lowest market prices.

It yields 10,996 cubic feet of gas to the ton of 2,240 lbs. of good illuminating power, and of remarkable purity; one bushel of lime purifying 6,792 cubic feet, with a large amount of coke of good quality.

It has been for many years very extensively used by various Gas Companies in the United States, and we beg to refer to the Manhattan, Metropolitan, and New York Gas Light Companies of New York; the Brooklyn and Citizen's Gas Light Companies of Brooklyn, N. Y.; the Baltimore Gas Light Company of Baltimore, Md., and the Providence Gas Light Company, Providence, R. I.

Best dry coals shipped from Locust Point, wharves, and prompt attention given to orders for chartering of vessels.

224-1y n

THE DESPARD COAL COMPANY
OFFER THEIR SUPERIOR
DESPARD COAL

To Gas Light Companies throughout the country.
Agents, PARMELEE BROTHERS, No. 32 Pine street, N. Y.
BANGS & HORTON, No. 31 Duane street, Boston.
Mines in Harrison County, West Virginia.
Wharves Locust Point, } Baltimore.
Company's Office, 15 German St., }

Among the consumers of Despard Coal, we name: Manhattan Gas Light Company, New York; Metropolitan Gas Light Company, New York; Jersey City Gas Light Company, N. J.; Washington Gas Light Company; Portland Gas Light Company, Maine

*** Reference to them is requested. 204-

TYRCONNELL GAS COAL.,

MINED IN TAYLOR COUNTY, WEST VA.

Company's Office, 52 S. Gay St., Baltimore.
CHARLES MACKALL, Secretary.
CHARLES W. HAYS, Agent, Room 7, 111 B'way, N. Y.
SHIPPING POINT—Baltimore, Md.

This coal yields 10,000 cubic feet of Gas with an illuminating power of over 16 candles. Forty bushels of very superio oke, with little Ash and scarcely any clinker 94-1y

---

GEO. W. DRESSER,

CIVIL ENGINEER.

TRINITY BUILDING

ROOM 89. 111 BROADWAY.

GAS COALS.

THE

PENN GAS COAL COMPANY

OFFER THEIR

COAL, CAREFULLY SCREENED,

AND PREPARED FOR

GAS PURPOSES.

Their Property is located in the Youghiogheny Coal Basin, near Irwin's and Penn Station on the Pennsylvania Railroad, and on the Youghiogheny River.

OFFICES

No. 209 South Third Street, Phil'a. 90 Wall Street, New York.

PLACES OF SHIPMENT.

Pennsylvania Railroad, Pier No. 2 (Lower Side).
Greenwich Wharves, Delaware River.
366-1y **Pier No. 1 (Lower Side), South Amboy, N. J.**

CANNELTON COAL COMPANY

Miners of the celebrated **CANNELTON CANNEL,** acknowledged to be the *best enricher* produced in this country, yielding **10,000** cubic feet of **64.54** candle gas per ton of 2,240 pounds.

J. TATNALL LEA, Treasurer, P. O. Box 1747 Philadelphia.

SALES AGENTS: **PERKINS & CO.,** New York. **DANIEL W. JOB & CO.,** Boston. **MAYER, CARROLL & CO.,** Baltimore.

The West Fairmont and Marion Consolidated Coal Company,

Mines at Fairmont, West Virginia,

OFFER FOR SALE THEIR

VERY SUPERIOR GAS COAL,

IN ANY QUANTITY DESIRED, on the shortest notice, at their office, 231 BROADWAY, New York

---

FORT PITT GAS COAL

THE FORT PITT COAL CO.

OFFER THEIR CELEBRATED

Fort Pitt Gas Coal,

Carefully Screened and Prepared for Gas Purposes, Delivered at any Point reached by Railroad or Navigation, on the Most Favorable Terms.

Office, No. 337 Liberty Street,

PITTSBURGH, PENN.

Box 314. J. E. McCRICKART, Manager.

"SCOTT'S" OCEAN MINE

Youghiogheny Gas Coal.

The undersigned, agents for the above well-known Gas Coal, are prepared to contract for its delivery at any point in New York and New England. Shipments made immediately if desired.

PERKINS & CO.,

41 SOUTH STREET, NEW YORK, Box 3695.

INTERNATIONAL--1876--EXHIBITION.

The U. S. Centennial Commission

HAVE DECREED AN AWARD TO

HARRIS, GRIFFIN & CO.,

12th and Brown Sts., Philadelphia, and 49 Dey St., N. Y., U. S, A.,

FOR THE FOLLOWING REASONS:

The Exhibit consists of a Series of METERS from the Largest Size Station Meters for the use of the MANUFACTURE OF GAS, to those for the use of the ORDINARY CONSUMER. The Instruments are WELL MADE, RELIABLE as to INDICATION, and embody a number of sundry improvements which with the general character of the Exhibit, entitle the whole to commendation.

Attest—J. L. CAMPBELL, Secretary, pro-tem. Signed—A. T. GOSHORN, Director General J. R. HAWLEY, President.

GROUP JUDGES.

AMERICAN.

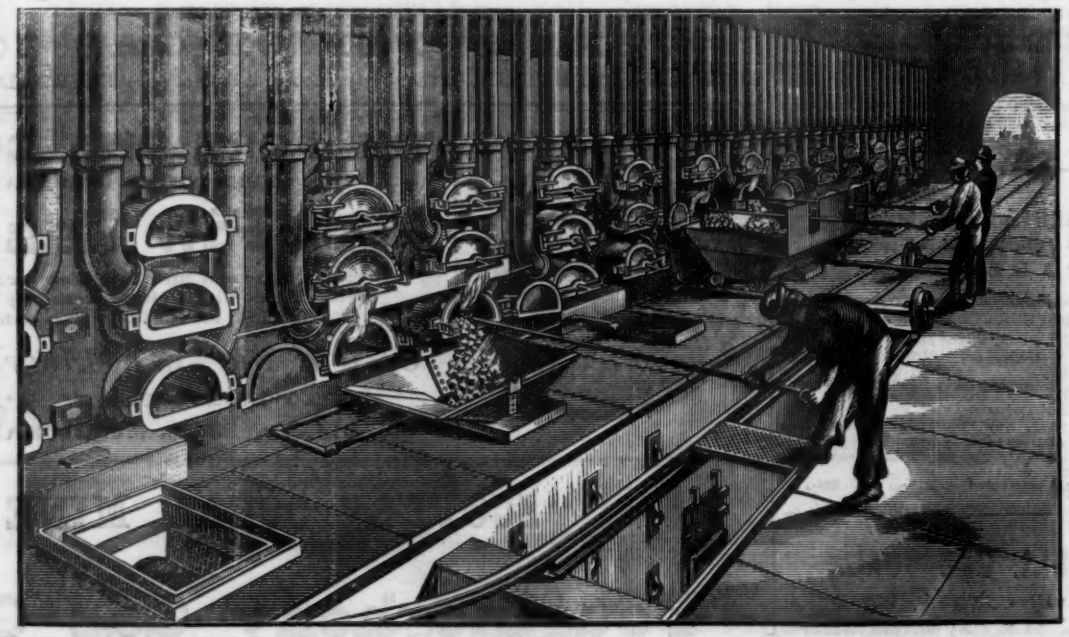
PROF. JOSEPH HENRY, LL.D., Secretary of Smithsonian Institution, Washington, D. C.
PROF. F. A. P. BARNARD, S.T.D., LL.D., President of Columbia College, N. Y.
PROF. J. E. HILGARD, Washington, D. C.
PROF. J. C. WATSON, Ann Arbor, Michigan.
GENERAL HENRY K. OLIVER, Salem, Massachusetts.
GEORGE F. BRISTOW, New York.

FOREIGN.

SIR WILLIAM THOMSON, LL.D., D.C.L., F.R.S., Great Britain
JUL. SCHIEDMAYER, Germany.
MR. E. LEVASSEUR, France.
P. F. KUPKA, Austria.
EDW. FAVRE PERRET, Switzerland.

Chas. F. Dieterich's Regenerator Furnace.

CAN BE ADAPTED TO ANY BENCH WITHOUT DISTURBING THE ORDINARY SETTINGS.



These Furnaces have been in operation at the works of the People's Gas Company, Baltimore, since June, 1878. A bench of 6's, with retorts 20in.x12in.x8ft. 6in., will burn off 1,350 pounds of coal in 3 hours. Twenty-five per cent. of the coke is sufficient to thoroughly burn off the charges.

State, city, and factory rights granted on reasonable terms. For full particulars apply to either

CHAS. F. DIETERICH, Eng'r People's Gas Co., BALTIMORE, MD.

WM. FARMER, 111 Broadway, N. Y., F. L. HAGADORN, 162 Beach St. Chicago, Ill., or HENRY J. DAVISON, 231 Broadway, N. Y.

T. C. HOPPER, Prest. and Gen. Supt. WM. H. HOPPER, Vice-Prest. WM. N. MILSTED, Treas. WM. H. DOWN, Sec.

AMERICAN METER COMPANY,

WET AND DRY GAS METERS. PRESSURE REGISTERS. METER PROVERS.
STATION METERS. PRESSURE & VACUUM REGISTERS. PORTABLE TEST METERS.
EXHAUSTER GOVERNORS. PRESSURE & VACUUM GAUGES. EXPERIMENTAL METERS.
DRY CENTRE VALVES. CRESSON GAS REGULATORS. AMMONIA TEST METERS.
GOVERNORS FOR GAS WORKS. MARSLAND WATER METERS. BAR AND JET PHOTOMETERS.

Manufactories:
512 W. 22d St., N. Y.
Arch & 22d Sts., Phila.

GAS STOVES—AMERICAN, FRENCH, & ENGLISH.
SUGG'S ILLUMINATING POWER METER.
SUGG'S "STANDARD" ARGAND BURNERS. ALSO NN AND TTT.
Wet Meters, with Lizar's "Invariable Measuring" Drum.
SOLE AGENTS FOR THE ALLEN EXHAUSTER GOVERNOR.

Agencies:
37 Water Street, Cincinnati.
20 South Canal Street, Chicago.
810 North Second Street, St. Louis.
122 & 124 Sutter St., San Francisco.

HELME & McILHENNY,

Successors to Harris & Brother.

ESTABLISHED 1848.

PRACTICAL GAS METER MANUFACTURERS,

Continue as heretofore at the OLD ESTABLISHMENT, Nos. 1115 and 1117 Cherry Street, Philadelphia, Pa.,

To manufacture Wet and Dry Gas Meters, Station Meters, Experimental Meters, Meter Provers, Centre Seals, Governors, Pressure Registers, Indicators, Photometers, and all kinds of Gas Apparatus; Also furnish all other Articles appertaining to the use of Gas Works.

From our long Practical Experience of the Business (covering a period of 33 years) and from our personal supervision of all Work, we can guarantee all orders to be executed promptly, and in every respect satisfactorily.

WILLIAM HELME. JOHN McILHENNY.

WM. WALLACE GOODWIN, Prest. and Treas. WM. H. MERRICK, V.-Prest. H. DUMONT WAGNER, Supt. S. L. JONES, Sec. S. V. MERRICK, Asst. Sec.

THE GOODWIN GAS STOVE AND METER COMPANY,

Successors to W. W. GOODWIN & CO.

No. 1012, 1014 and 1016 Filbert Street, Philadelphia, Pa.

No, 142 Chambers Street, New York

MANUFACTURERS OF GAS STOVES FOR COOKING AND HEATING PURPOSES.

Dry and Wet GAS METERS, Station Meters (Square, Cylindrical or in Staves) Glazed Meters, King's and Sugg's Experimental Meters, Lamp Post Meters, Etc., Etc., Meter Provers (sizes 2, 5 and 10 feet), Pressure Guages of all kinds, Pressure Registers, Pressure and Vacuum Registers, Pressure Indicators (sizes 4 inch, 6 inch and 9 inch), King's Pressure and Vacuum Gauges, Dry and Wet Centre Seals, Dry and Wet Governors, Exhauster Governors, Photometers of all descriptions. Letheby's Sulphur and Ammonia Test Apparatus complete—also Testing and Chemical Apparatus of all kinds, and of the most perfect description, for all purposes relating to Gas.

Goodwin's Improved Lowe's Jet Photometer.

Special attention to repairs of Meters, and all apparatus connected with the business.
All work guaranteed first class in every particular, and orders filled promptly.

Review of Gas and Water Engineering.

ISSUED EVERY ALTERNATE FRIDAY.

Edited and Published by CHAS. W. HASTINGS, 8 Buckingham St., London, Eng.

Each number contains articles in connection with the manufacture and supply of Gas; summary of latest intelligence on the subject of Electric Lighting; articles upon Water Supply; also on the Construction and Maintenance of Gas, Water, and Sewage Works.

Price, 10s., Postpaid.

The Gas and Water Companies' Directory.

Edited and Published Annually by CHARLES W. HASTINGS.

This Work gives a complete list of all Gas and Water Companies throughout England, Scotland, Ireland and Wales; date of formation, amount of capita and names of all officers, etc.; including carbon returns, prices paid for gas, dividends, etc.

Price, in Cloth Covers, 5s.; Paper Covers, 3s. 6d. Postage Extra.

Address, 8 BUCKINGHAM STREET,
Orders Received at this Office. LONDON, W. C., ENGLAND.

NOW READY AND FOR SALE,

FODELL'S
System of Bookkeeping

FOR GAS COMPANIES.

Price $5, which should be sent either in Check, P. O. Order or Registered Letter.

Blank Books, with printed headings and forms on this system, will be supplied to Gas Companies, by applying to W. P. FODELL Philadelphia, or

A. M. CALLENDER & CO
OFFICE GAS LIGHT JOURNAL, 42 Pine St., N. Y

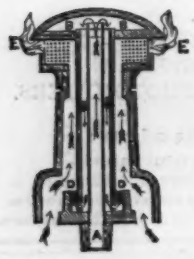
CATHEL'S
GAS CONSUMERS MANUAL.

Enables every Gas Consumer to ascertain at a glance, without any previous knowledge of the Gas Meter, the quantity and money value of the Gas consumed. Also the best method of obtaining from Gas the largest amount of its light.

It will be to the advantage of Gas Companies to supply their Consumers with one of these Guides, as a means of preventing complaints arising from their want of knowledge in regard to the registration of their meters. For sale by

A. M. CALLENDER & CO.
42 Pine Street, New York, Room 16.

The Celebrated Retort Gas Cooking Stoves



The annexed cut shows the principle of the Retort Gas Stoves. *The gas is superheated before its union with the air*, by passing the same through inner tube A, into retort B. It then descends to chamber C, passes through argand burner D, where it unites with the air. By this process the gas is expanded three times in quantity, thus exposing three times the surface for the air to strike, whereby a much larger amount of air is made to unite with the same amount of gas than with any other gas stove.

ACKNOWLEDGED

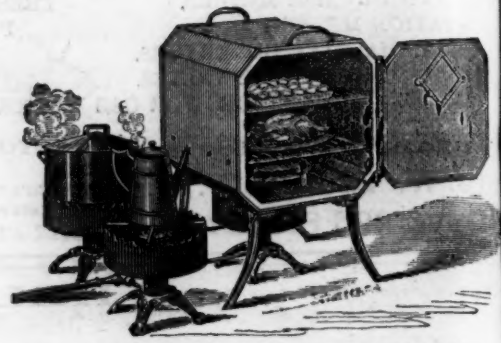
BY ALL SCIENTIFIC MEN

IN THE

United States, Great Britain, France, and Germany

TO BE

THE BEST.



No. 3 Retort Cook and No. 1 Portable Oven.

They do not light back when turned down low. They do not smoke nor smut your dishes. No smell of unconsumed gas.

CAST IRON FRONTS, NICKEL-PLATED TRIMMINGS. ALL SIZES AND PRICES.

THESE STOVES BAKE AND ROAST BY DIRECT HEAT, AND GRILL BY DEFLECTED HEAT,

No. 8. Retort Gas Cooking Stove.

THEY DO THE ENTIRE FAMILY COOKING, AND GIVE UNIVERSAL SATISFACTION.

An Economy over other Gas Stoves of 25 per cent. actually Guaranteed.

RETORT GAS STOVE COMPANY,

OFFICE & MANUFACTORY, 210, 212, & 214 EDDY ST.,

Providence, Rhode Island, U. S. A.

FRED. I. MARCY, President. H. N. SMITH, Treasurer.